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METAL FINISHING

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Inhibited Acids in Plating Cycles
Report on Use of Inhibited Acids

Electroplating for Shelf Life
Choosing the Most Suitable Coating

Continuous Pickling Stainless Steel
Equipment Employed at Sheffield, England Plant of Firth-Vickers

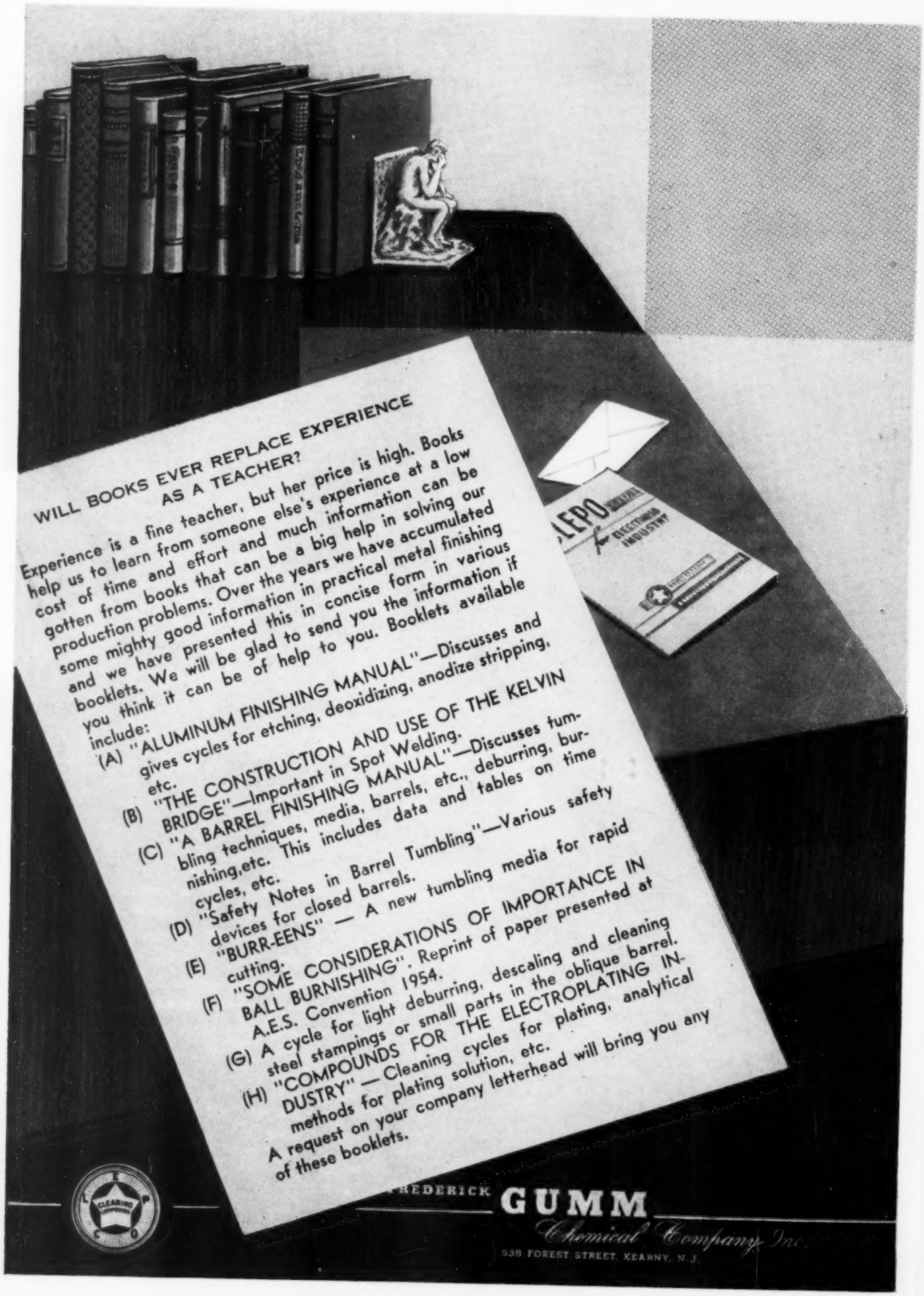
Surface Treatment and Finishing of Light Metals
Chemical Conversion Coatings

Science for Electroplaters
A Course in Fundamentals of Chemistry

Complete Contents Page 57

WHERE PLATERS AND FINISHERS LOOK FOR INFORMATION
WESTWOOD, N. J.
FINISHING PUBLICATIONS, INC.

READ & PASS ON


WILL BOOKS EVER REPLACE EXPERIENCE AS A TEACHER?
Experience is a fine teacher, but her price is high. Books help us to learn from someone else's experience at a low cost of time and effort and much information can be gotten from books that can be a big help in solving our production problems. Over the years we have accumulated some mighty good information in practical metal finishing and we have presented this in concise form in various booklets. We will be glad to send you the information if you think it can be of help to you. Booklets available include:
(A) "ALUMINUM FINISHING MANUAL"—Discusses and gives cycles for etching, deoxidizing, anodize stripping, etc.
(B) "THE CONSTRUCTION AND USE OF THE KELVIN BRIDGE"—Important in Spot Welding.
(C) "A BARREL FINISHING MANUAL"—Discusses tumbling techniques, media, barrels, etc., deburring, burnishing,etc. This includes data and tables on time cycles, etc.
(D) "Safety Notes in Barrel Tumbling"—Various safety devices for closed barrels.
(E) "BURR-EENS" — A new tumbling media for rapid cutting.
(F) "SOME CONSIDERATIONS OF IMPORTANCE IN BALL BURNISHING". Reprint of paper presented at A.E.S. Convention 1954.
(G) A cycle for light deburring, descaling and cleaning steel stampings or small parts in the oblique barrel.
(H) "COMPOUNDS FOR THE ELECTROPLATING INDUSTRY" — Cleaning cycles for plating, analytical methods for plating solution, etc.
A request on your company letterhead will bring you any of these booklets.
LEPO
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FREDERICK GUMM
Chemical Company, Inc.
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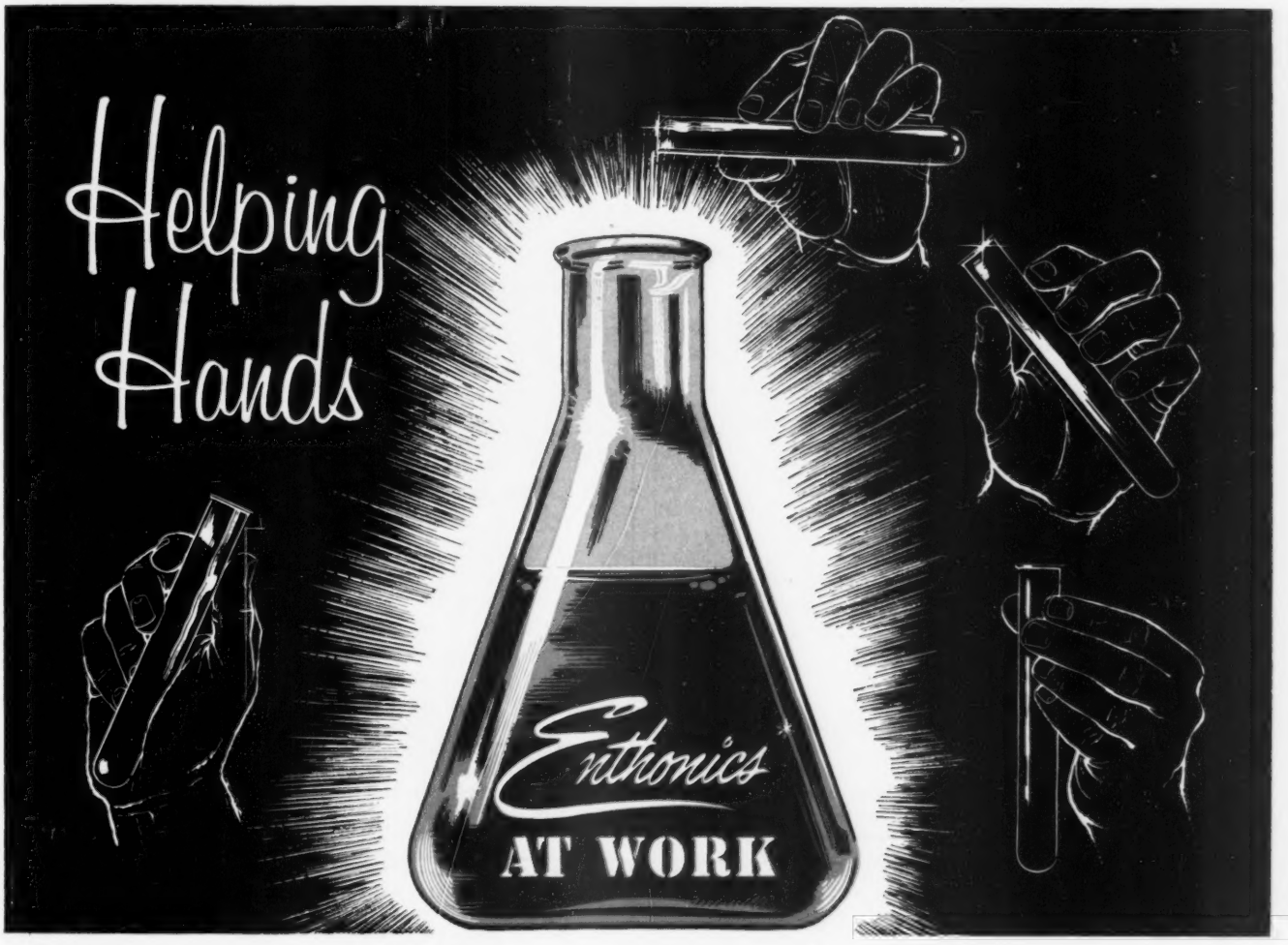

FROM THOUSANDS of TESTS . . .

. . . *come the solutions to your metal finishing problems.*

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1. HOW TO BLACKEN copper, brass, zinc, steel and other metals to meet U.S. Government specifications.
2. HOW TO STRIP NICKEL from steel without etching the steel.
3. HOW TO STRIP NICKEL from copper and brass without attacking the part.
4. HOW TO SHED WATER from metals to prevent staining or spotting during drying.
5. HOW TO TRAP FUMES from hot sulfuric acid pickles.
6. HOW TO STRIP SYNTHETIC ENAMELS from aluminum and other metals without attacking the metal.
7. HOW TO CLEAN AND REMOVE RUST AND OXIDES from steel in one operation without acids.
8. HOW TO RINSE AND DRY STEEL WITHOUT RUSTING, using cold or hot water.
9. HOW TO SHORTEN ALKALI CLEANING TIME for steel to 15 seconds.
10. HOW TO REMOVE SOLID DIRT AND OIL from metals.
11. HOW TO STRIP LEAD, TIN or soft solder from copper and brass with no etching.
12. HOW TO PLATE METALS upon aluminum.
13. HOW TO REMOVE EXCESS SILVER SOLDER chemically from silver brazed steel parts.
14. HOW TO MAKE PAINT STICK to brass and zinc.
15. HOW TO SOLVENT-CLEAN parts and assemblies with cold non-hazardous solvent.
16. HOW TO OVERCOME CHROMIC ACID CONTAMINATION in cleaners.
17. HOW TO PREVENT STAINING of chromium plate.
18. HOW TO GIVE ZINC AND CADMIUM high salt spray resistance.
19. HOW TO COLOR ALUMINUM in one operation.
20. HOW TO STRIP METAL COATINGS from zinc die castings.

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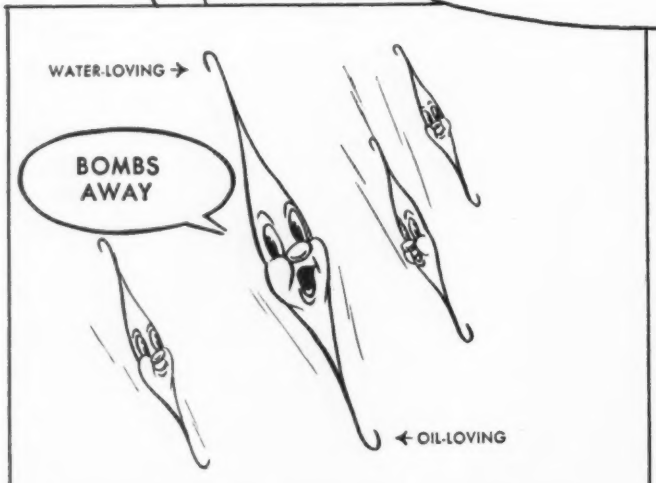
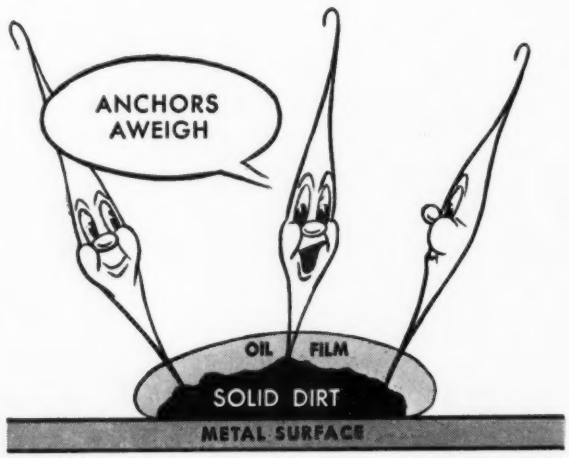
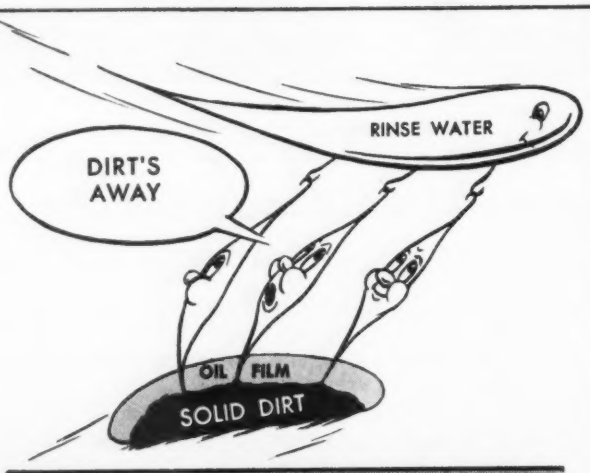


Each molecule of surface-active agent in the solvent detergent has an "oil-loving" end and a "water-loving" end.



Each "oil-loving" end hooks itself to the oil in dirt on a metal surface.



Each "water-loving" end hooks itself to rinse water. Result: Solvent, oil and solid dirt are swept away in the rinse.

FREE This 24-page illustrated booklet tells all about Oakite solvent detergents. Write for your copy.

Oakite solvent detergents make it easy for you to remove heavy soils such as drawing and buffing compounds and thick deposits of other oils and greases.

Oakite solvent detergents may be used in spray washing machines or in tanks. They offer many advantages: speedy removal of stubborn soils, safety for all metals, economy, reduction of fire hazards, protection against rusting.

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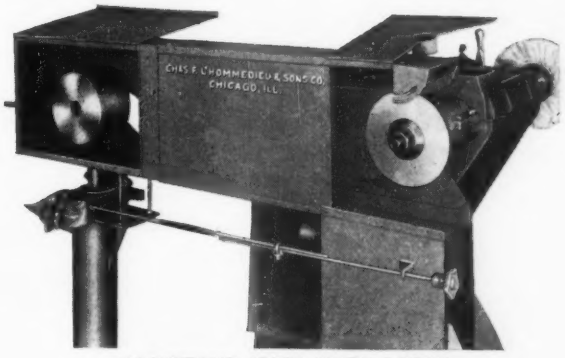
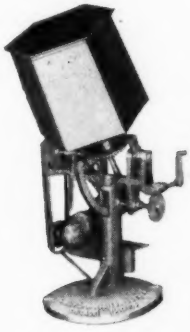
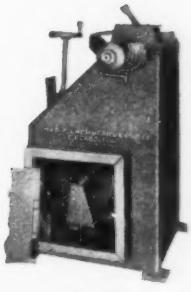


BACKSTAND IDLER WITH LATHE

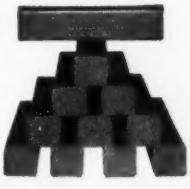


OBLIQUE
TUMBLING BARREL



#23A
POLISHING LATHE

BACKSTAND IDLER



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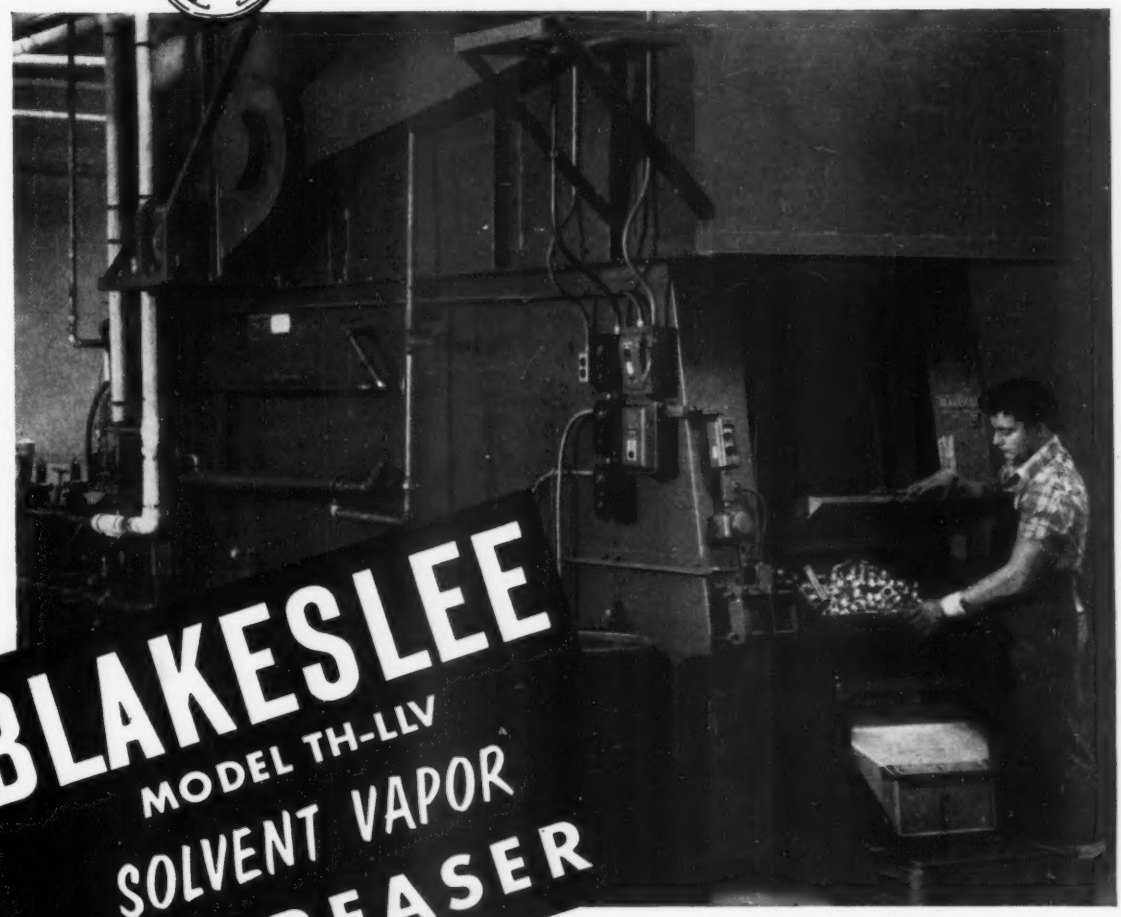

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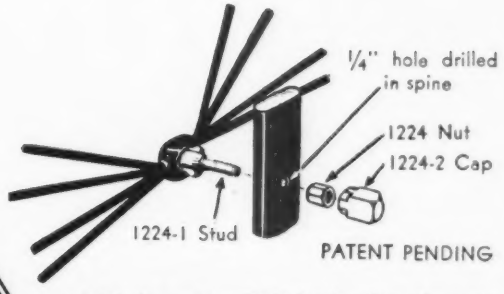

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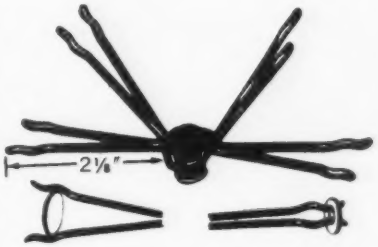
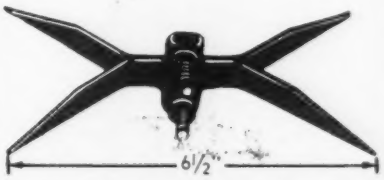
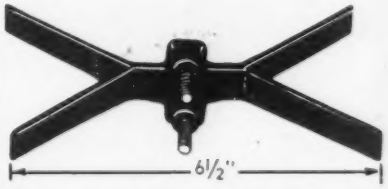


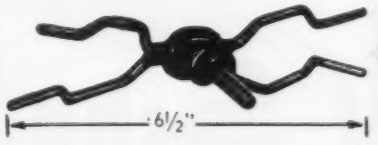
RS-207. Same design as the popular Style 1 Utility Tip. Has 8 prongs arranged in 4 pairs—formed to hold objects under spring tension from either inside or outside. Wire sizes: 1/16", .072" and .080". Universal Plastic Coated.



FS-102. Same design as the Style 4 Utility Tip, except has double knurler. 1/16" x 5/8" phosphor bronze. Universal Plastic Coated.



FS-101. Same design as Style 3 Utility Tip, except has double knurler. Excellent for racking objects that tend to wobble. Square ends are easily shaped when necessary. 1/16"x5/8" phosphor bronze. Universal Plastic Coated.



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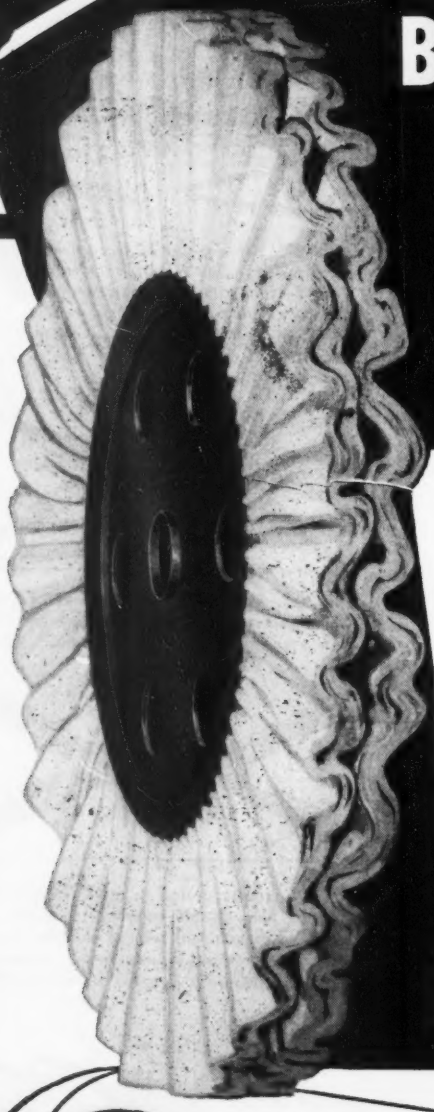

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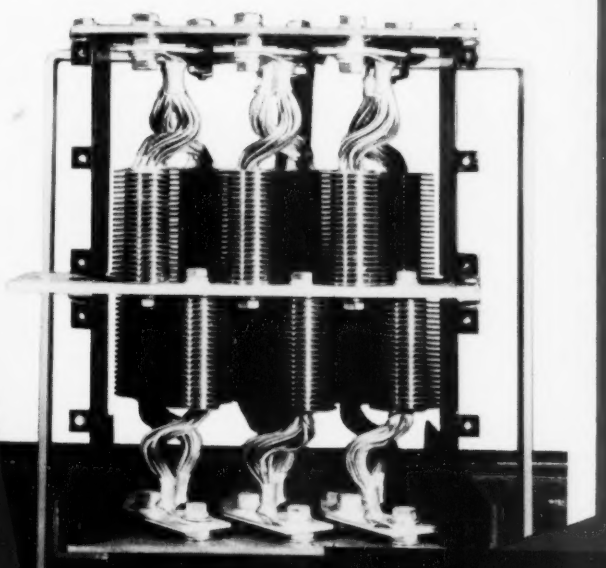

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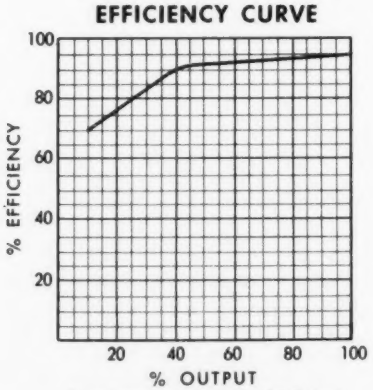
Here they are!

The new Rapid Electric Company Germanium Rectifiers are the result of years of experience in the design and manufacture of DC Power Supplies. Rapid Germanium Rectifiers offer greater efficiency, easier trouble-free operation and have a longer life expectancy than any other large DC Power Supply units available. They are truly the last word.

Efficiency

Designed for full load operation, Rapid Germanium Rectifiers operate most efficiently at full load. The curve shows efficiency tests on one of our 24 volt DC Output models. Note the 95% efficiency at full load.

TYPICAL GERMANIUM EFFICIENCY CURVE



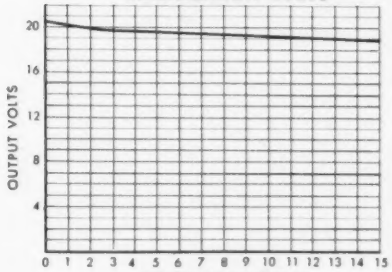
*Measurement at 24 Volts DC Output

This high efficiency is accomplished by the low forward resistance, high inverse resistance and negligible heat generation of the Germanium junction. To further increase the basic efficiency of the junctions, each one is electrically balanced and is of special mechanical construction.

Voltage Stabilization

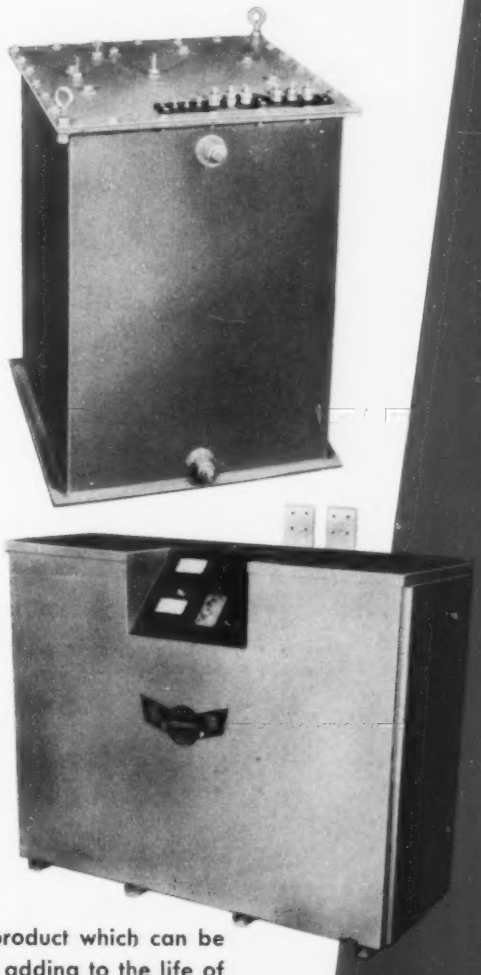
Inasmuch as RAPID GERMANIUM units have a higher efficiency than any known rectifier element commercially available at the present time our design and construction has resulted in successful voltage stabilization equal to previous methods but accomplished without the use of additional components. For example, on rectifiers having a 24 volt output we have successfully maintained a minimum voltage variation of less than ±1 volt when operated from no load to full load.

TYPICAL GERMANIUM VOLTAGE STABILIZATION CURVE



Controls

Rapid Germanium Rectifiers feature an oil immersed, continuously variable inductor control. Fully motorized, it offers ease of operation combined with tight control to vary the output from zero to full rated load. Two buttons, marked "raise" and "lower" are furnished. To increase or decrease the output, merely depress the proper button until the meter shows the desired reading. That's all there is to it!



Size

Electrically — for the present, models are available from 300 to 50,000 Amperes DC output.

Physically — There are many installations where space limitations have discouraged the use of conventional DC Power Supplies. With the elimination of heretofore necessary components in present conventional rectifiers plus the high efficiency obtained in the RAPID GERMANIUM units, it has been possible to reduce the cubicle sizes of all units.

Sealed Unit

Intensive, detailed engineering design has resulted in a successful, tested product which can be almost 100% completely sealed from adverse atmospheric conditions thus adding to the life of the complete unit. The use of elaborate fans and cooling systems has been eliminated in the RAPID GERMANIUM units. The junctions are hermetically sealed.

Life Expectancy

As a result of the high efficiency 120°C operating temperature range, low heat generation and other exclusive design features of the RAPID GERMANIUM junction, full capacity life tests have indicated conclusively that the life expectancy of the units will greatly exceed that of all present types.

For example, after 1000 hours at full rated loads, no aging or change in the characteristics of the Germanium junctions was observed.

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In Industry:

It is with a good deal of pride that we announce the availability of our NEW GERMANIUM RECTIFIERS. They are in production now, and shipments are being made in ever-increasing numbers.

In keeping with our policy of continually supplying industry with the ultimate in DC Power, we have directed our research effort for the past two years towards the development of this new source of power.

We honestly believe that our new GERMANIUM RECTIFIERS far surpass any DC power supply available today from the standpoint of efficiency (up to 95%), dependability, and long life.

We invite you to learn more of this new source of power as it applies to your problems.

Let us hear from you.

Sincerely yours,
RAPID ELECTRIC COMPANY

James A. Viola

James A. Viola
President

REMEMBER.....

MEANS *"More power to You!"*

Luxurious 1955 Packard 400 Hardtop — product of Studebaker-Packard Corporation, Detroit, Michigan.

Packard parts begin life with a Wyandotte bath

In the production of the great new Packards for 1955, Wyandotte products are used in vital cleaning processes: ALTREX* for aluminum soak cleaning; INDUSTRIAL D in spray washers, to remove fabricating compounds and other soils from steel parts; R-2 as an in-process rust inhibitor in spray rinses.

In fact, Packard has been using Wyandotte products for more than ten years — for more effective cleaning at lower use-cost. For in the manufacture of fine motorcars, quality is the foremost requirement — and cost is an important factor as well.

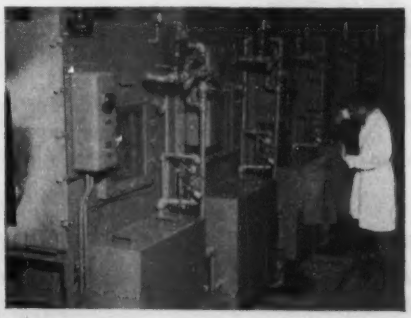
How about *your* business? Wyandotte offers the most complete line of metal cleaners in the industry: for burnishing and deburring; vat, steam-gun, washing-machine and emulsion cleaning; electrocleaning; rust removal; paint stripping; spray booths.

For technical assistance and data, call in your Wyandotte service representative, today. Or write us, c/o Dept. 2315, detailing your needs, along with specifications and requirements. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

*REG. U.S. PAT. OFF.

Call on Wyandotte to improve quality, cut costs

Packard uses Wyandotte cleaners in small soak tanks, to rid parts of cutting oil and soil; and in spray washes and spray rinses.



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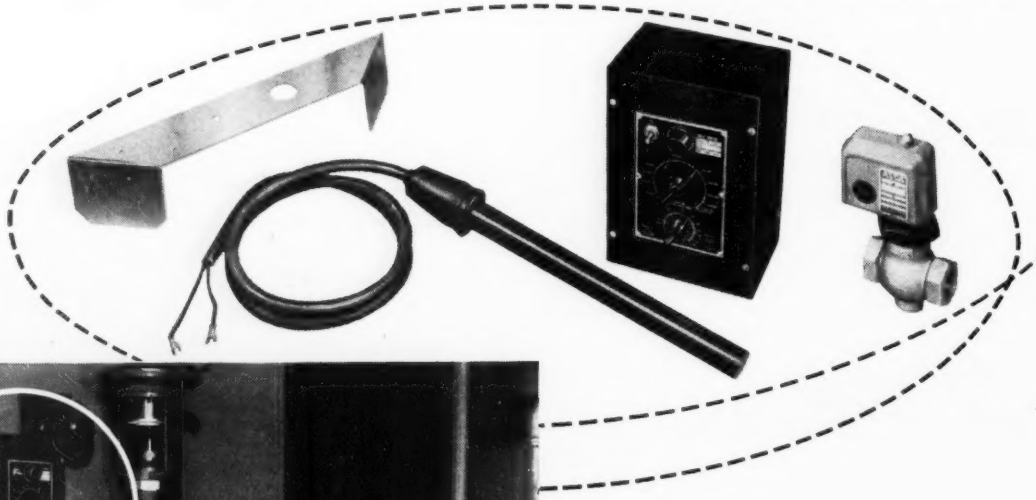
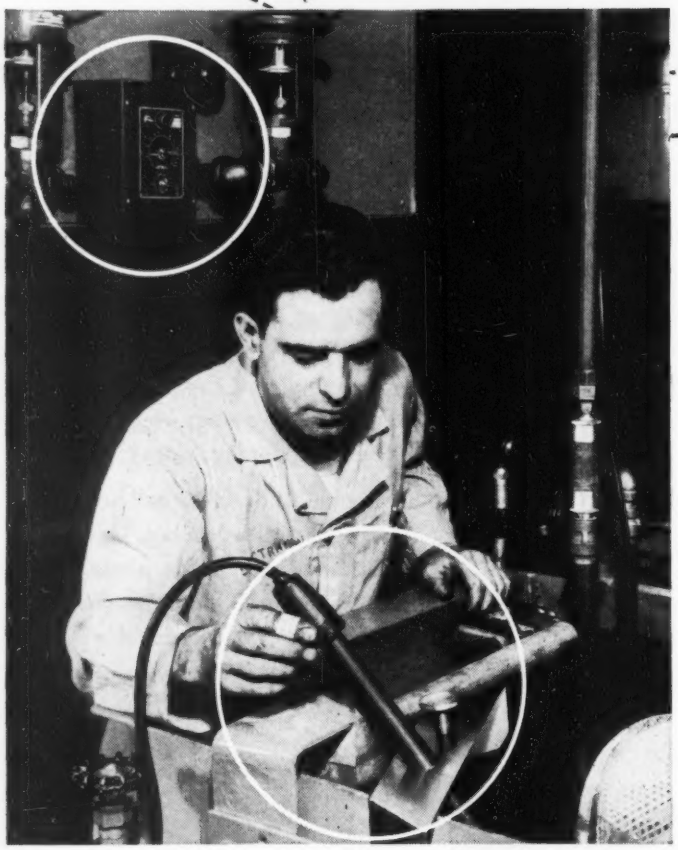
SLASH YOUR WATER BILLS...

SOLU BRIDGE *Automatic* RINSE TANK CONTROLLER





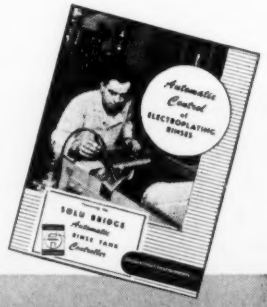
Water savings effected by a **Solu Bridge Automatic Rinse Tank Controller** installation are frequently more than 50%. An Eastern gold-plating plant, for instance, has reduced its water bill by a rate exceeding $10,000 per year.

Furthermore, because of serious water shortages in many areas, as well as the growing influence of Federal Law No. 845 (making stream pollution a Federal responsibility), there is sharply increased interest by platers in the batch treatment of collected rinse waters.

The Complete Kit 1-1 shown above. Conductivity Cell is placed in rinse tank. Solu Bridge (conveniently located) automatically turns on and off a water valve for given degree of rinse. Typical installation at left.

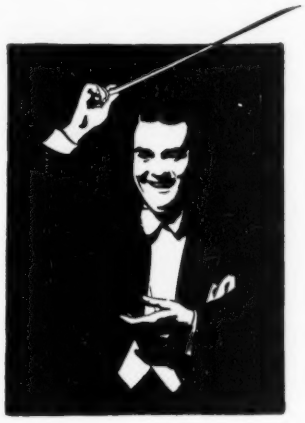
GET YOUR COPY...

Descriptive bulletin gives working details and economics. Ask your supplier to show you this remarkably inexpensive equipment. Or write us. A post-card will do.



Industrial Instruments INC.

89 COMMERCE ROAD, CEDAR GROVE (ESSEX COUNTY), N. J.



The Leader!

IN CADMIUM BRIGHTENERS IS

ROHCO® 20XL!

CHECK THESE POINTS:

1. Proved in over 6 years of use.

2. Such remarkable throwing power that frequently up to 40% of cadmium metal is saved by plating recesses to specification thickness without excessive build-up on external areas of work.

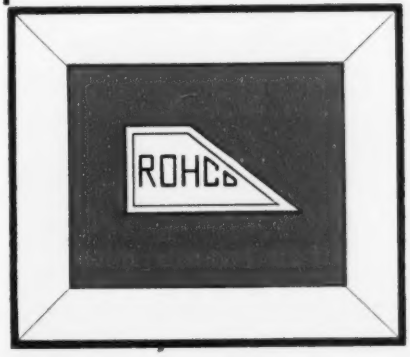
3. Such amazing covering power that many times inside anodes are eliminated to cover and plate recesses.

4. Maximum brilliance of deposit, greatest possible ease of control of the bath and widest plating range combine to make ROHCO 20XL the outstanding brightener. There just isn't anything like ROHCO 20XL—ask the man who's using it! ROHCO 20XL is the original liquid brightener—for ease of addition, but also available in powder if you prefer!

R. O. HULL & COMPANY, INC.

1303 Parsons Court • Rocky River 16, Ohio

DISTRIBUTORS: CHICAGO, Ardco, Inc. • TORONTO, CANADA, Armalite Company, Ltd. • LOS ANGELES-SAN FRANCISCO, Crown Chemical & Engineering Co. • NEWARK, Daniels Plating Barrel & Supply Co. • ST. LOUIS, Davies Supply & Manufacturing Co. • NEW ENGLAND, NEW YORK, PENNSYLVANIA, Enthone, Inc. • MINNEAPOLIS, W. D. Forbes Co. • DETROIT, George L. Nankervis Co. • FT. WORTH, DALLAS, Weaver Engineering & Supply Co.



JUST PIN THIS COUPON TO YOUR LETTERHEAD!

R. O. HULL & COMPANY, INC.
1303 Parsons Court
Rocky River 16, Ohio

Please send details on ROHCO 20XL CADMIUM BRIGHTENER!

Name ..... Title .....

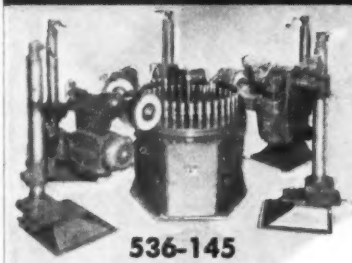
Company .....

Street Address .....

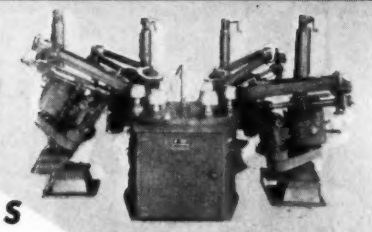
City ..... Zone ..... State .....

ACME *Rotary Automatics*

. . . cut costs on production finishing



536-145



512-9-2

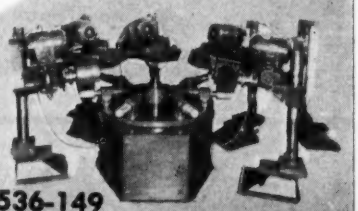
ROTARY TABLES ARE AVAILABLE IN SIZES UP TO 24 FT. DIAMETER

534-337

ACME 8 FT. *Combination Type* ROTARY AUTOMATIC

● This machine can be readily changed from a 32 spindle continuous rotary automatic to an 8 station indexing rotary automatic by simple hand crank adjustment. Various types of ACME adjustable floating head polishing and buffing lathes are used including belt arm attachments on buffing heads, utilizing the same heads for buffing or belt operations. Spindle arrangements are available in multiples of 8.

Rotary Catalog on Request.



536-149

RECOMMENDATIONS and QUOTATIONS . . . will be offered on receipt of blue prints or preferably finished and unfinished parts you contemplate finishing, together with details of your present finishing operations and production requirements.

SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

ACME *Manufacturing Co.*

Builders 1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

ATTENTION PLANT ENGINEERS!

In considering rigid, unplasticized Polyvinyl Chloride pipe, valves, fittings or custom fabrications watch for these 4 important factors:

1 **Is the product properly manufactured?**

Boltaron 6200 is produced under rigid standards by the Bolta Division of The General Tire and Rubber Company.

2 **Is it properly fabricated and designed?**

Only well-trained, experienced engineers and fabricators are qualified to fill your individual needs. Every Boltaron fabricator in the United States and Canada is trained and licensed by Hartwell & Son.

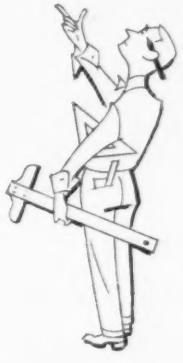
3 **Is the application right?**

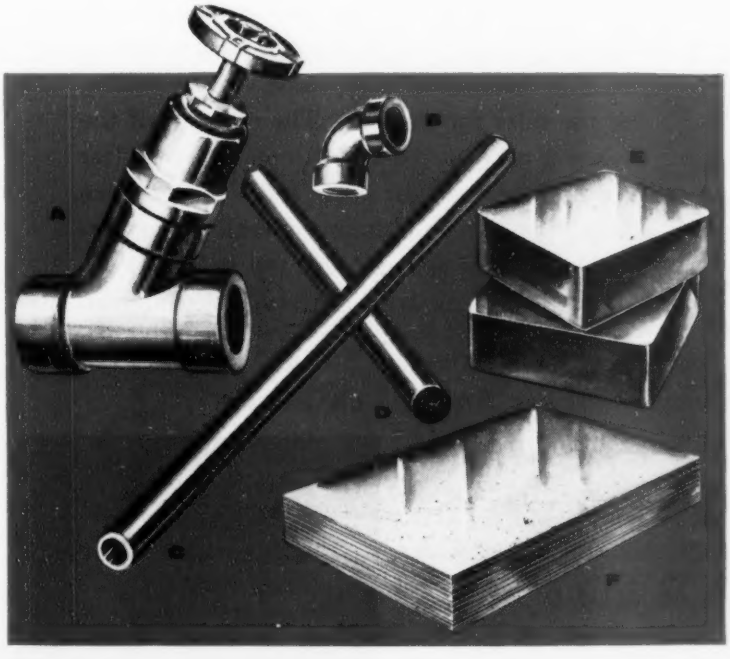
Unplasticized PVC is NOT a panacea for all industrial ills. It can and will perform with a high degree of satisfaction when properly applied to your specific problems.

4 **Are the company and the product proven in use?**

Hartwell & Son have been exclusive distributors of Boltaron for years. A list of their many successful installations in a wide range of industries can be supplied on request.

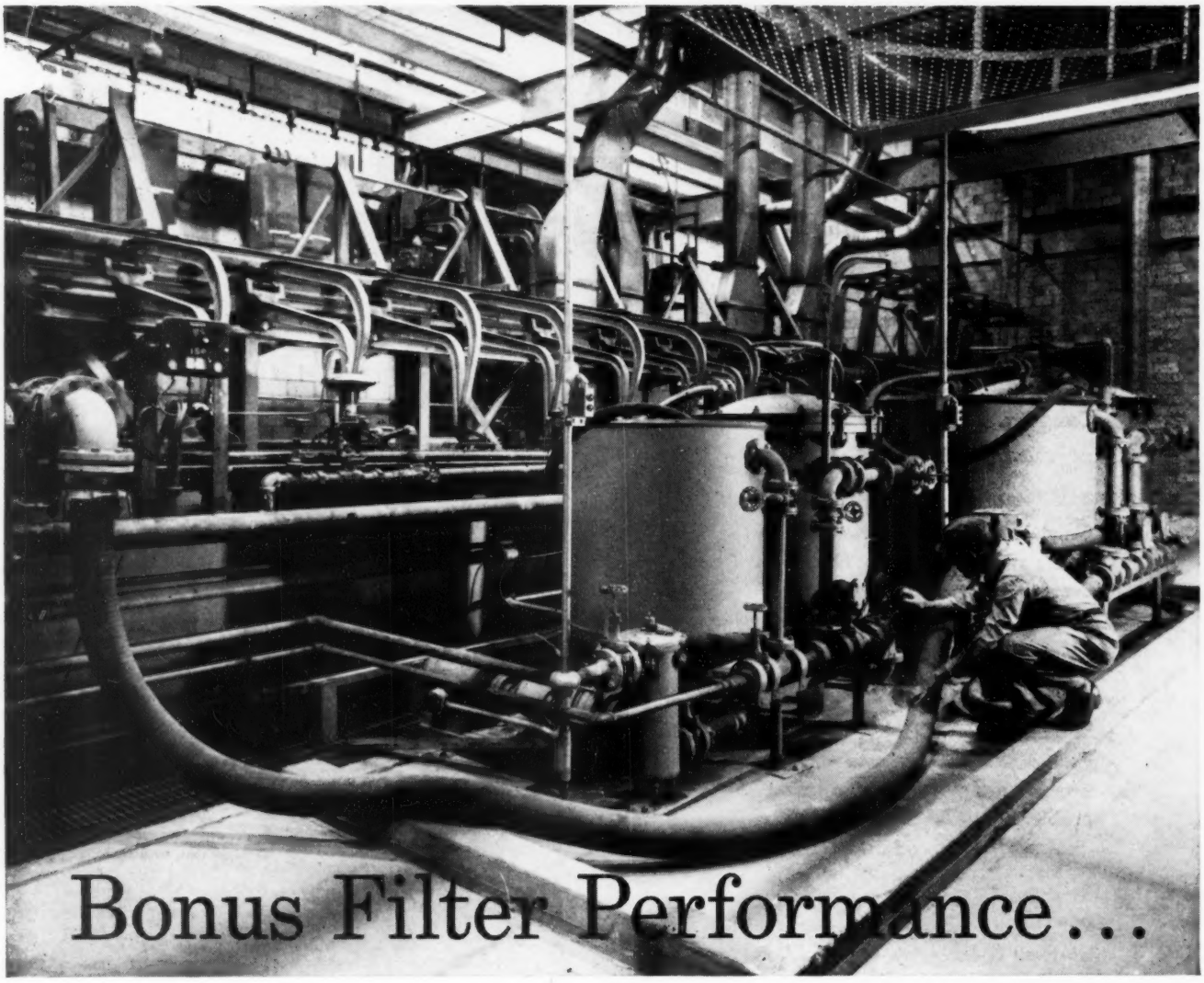
Boltaron **6200**





With Boltaron 6200 you can obtain *from one source* a complete line of unplasticized PVC materials. Substantial inventories are kept at all times for prompt shipments. For further information write H. N. Hartwell & Son, Inc., Park Square Building, Boston, Mass., Box 116.

A All-Molded Valves
B Molded Fittings
C Seamless Pipe
D Rod Stock
E Block Stock
F Sheet Stock



Bonus Filter Performance...

On Nickel Dip and Neutralizer Solutions at New Westinghouse Appliance Plant, Columbus, Ohio

A view of the two INDUSTRIAL filters—one on the nickel dip solution and one on the neutralizer solution. Each is a complete unit with primer-strainer tank, precoat slurry tank, filter, pumping unit, and all valves for filtration, addition of filter aids, free pumping, and filter drainage. Each filter is furnished with INDUSTRIAL air-wash manifold for cleaning filter.

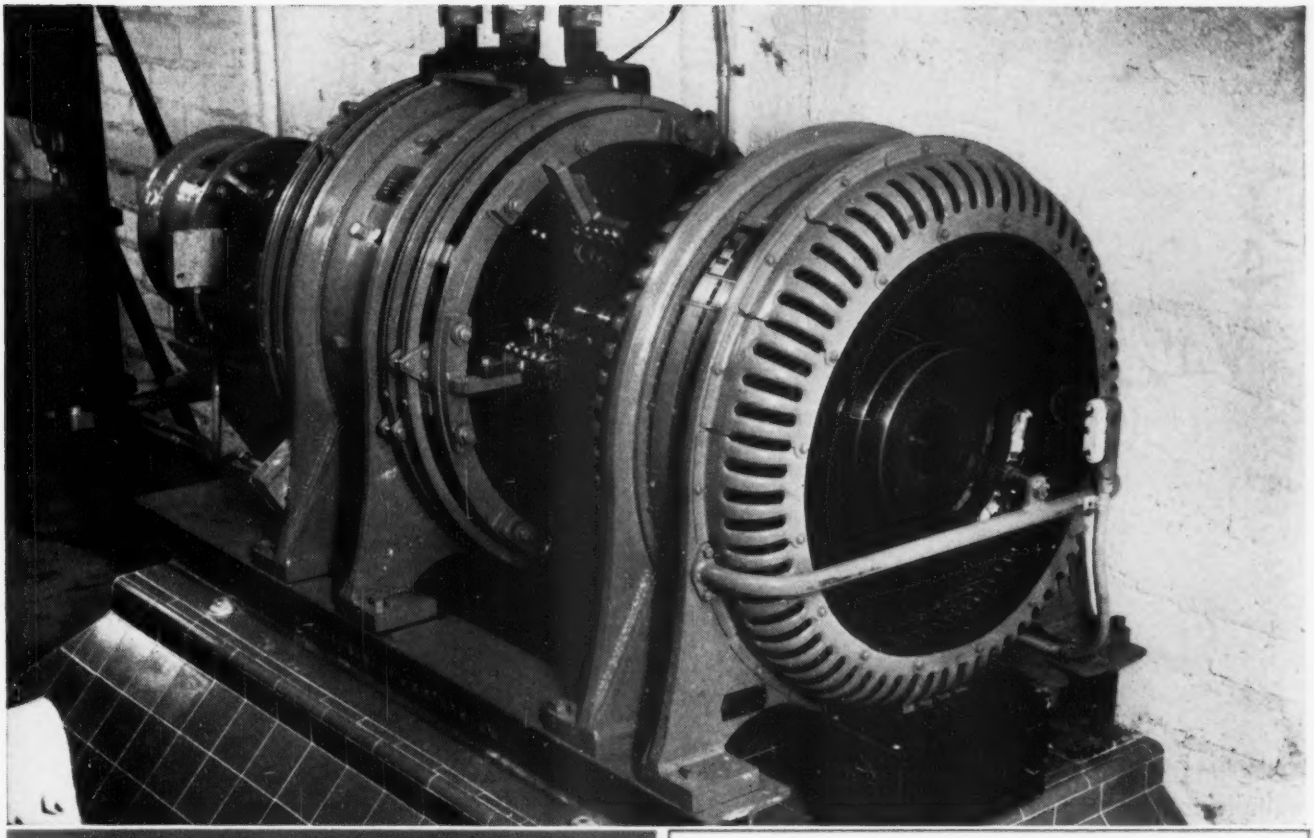
Adequate turnover in the continuous filtration of the nickel dip and neutralizer solutions by the INDUSTRIAL filters assures dependable clarity. Furthermore, the air-wash cleaning feature eliminates the opening or dismantling of the filter for cleaning. The removal of the cover is necessary only for replacing the filter cloths or for periodic inspection—a great time and labor saver. It is this overall bonus performance that accounts for the universal use of INDUSTRIAL filters with the vitreous enameling processes.

Full Particulars and Recommendations for Any Job on Request

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 OGDEN AVE., CHICAGO 50, ILLINOIS

PRESSURE FILTERS
ION EXCHANGERS
RUBBER LININGS
HEAT EXCHANGERS
CORROSION TEST CABINETS
CENTRIFUGAL PUMPS



INDUSTRY LEADERS CHOOSE

Chandeysson

ELECTROLYTIC GENERATORS

Example:

High Quality Plating Operations at Pemaco, Inc., Alhambra, California.

2000 ampere, 6 volt Chandeysson Generator is typical of the modern facilities in the Pemaco Plant.

Long life and continuous efficient operation of Chandeysson Generators is assured by a combination of the finest, most durable materials . . . proven design . . . and conservative engineering with plenty of overload capacity.

CONVERT WITH

Chandeysson

AND SAVE 4 WAYS

USE LESS POWER. . . precision-built for high efficiency and built-in voltage regulation.

BE SURE OF POWER WHEN YOU NEED IT MOST . . . overload capacity as great as 50% momentarily and 25% sustained, without distress or damage.

GET MORE OUT OF THE POWER YOU PAY FOR . . . built-in high power factor at no extra cost.

ENJOY LIFETIME POWER DIVIDENDS. . . sustained, lifetime overall constant efficiency as high as 85% does not decrease with age or overload.

For product information write for bulletins D-101 and D-102— for names of users and installation data ask for bulletin D-104.

CHANDEYSSON ELECTRIC COMPANY • 4074 Bingham Ave., St. Louis 16, Missouri 52

VERSATILITY

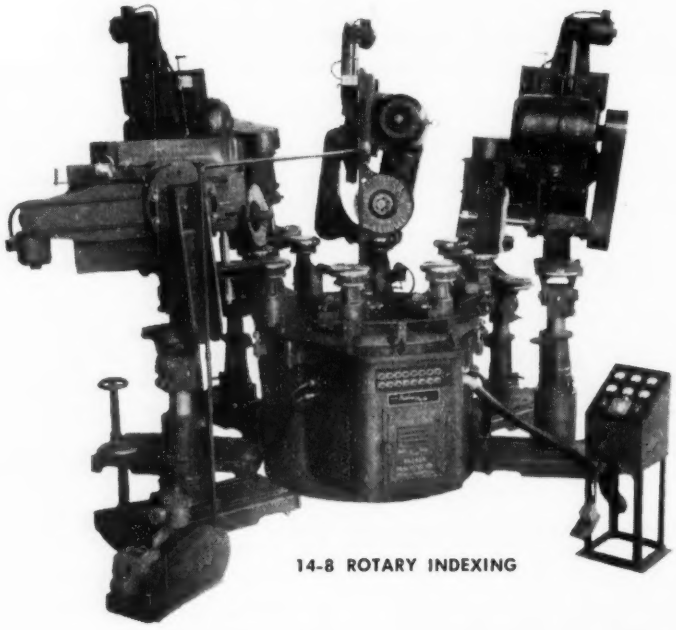
Packer-Matic's ability to handle multiple contour units in short runs is just one of the many sound reasons why cost conscious production men are selecting Packer Automatic Machines to solve their finishing problems.

The Unicycle pictured above depicts versatility in its own right. The Packer-Matic shown below is a perfect example of a modern piece of machinery designed to do many jobs; polishing, buffing or deburring, faster, more economically and with greater uniformity than hand operation.

Packer-Matics are leaders because they are designed specifically to perform a multiplicity of jobs with an efficiency that will increase customer satisfaction and profit.

Send your specifications today to ENGINEERING, for quotation.

THE PACKER MACHINE CO.
MERIDEN, CONNECTICUT



14-8 ROTARY INDEXING

PACKER-MATIC

AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

"tank life DOUBLED with . . .

Cowles NS CLEANER!"

reports large Midwestern manufacturer

That's what happened when this major manufacturer put Cowles NS —heavy duty soak cleaner—in its cleaner tanks. Tank life was doubled, quality of cleaning was improved, and total cost was reduced greatly.

Cowles NS eliminates soap scum build-up to assure long tank life and prevent deposition of scum on cleaned parts. High emulsification properties of Cowles NS keep the tank clear and reduce the costly, time-consuming process of dumping, cleaning and recharging tanks—jobs can be run *up to twice as long* without changing.

Cowles NS provides outstanding cleaning results and its flexibility permits its successful application in both porcelain enamel plants and in plating plants.

Your Cowles Technical Representative will be very happy to discuss your soak cleaning problems with you and help bring the same exceptional results with Cowles NS that this and many other plants have experienced. Write or call today.

Cowles CHEMICAL COMPANY

7016 Euclid Avenue • Cleveland 3, Ohio

For

- **Hard-to-cover parts . . .**
- **That increased hardness . . .**
- **Smooth, adherent, uniform deposit**

use

BRP

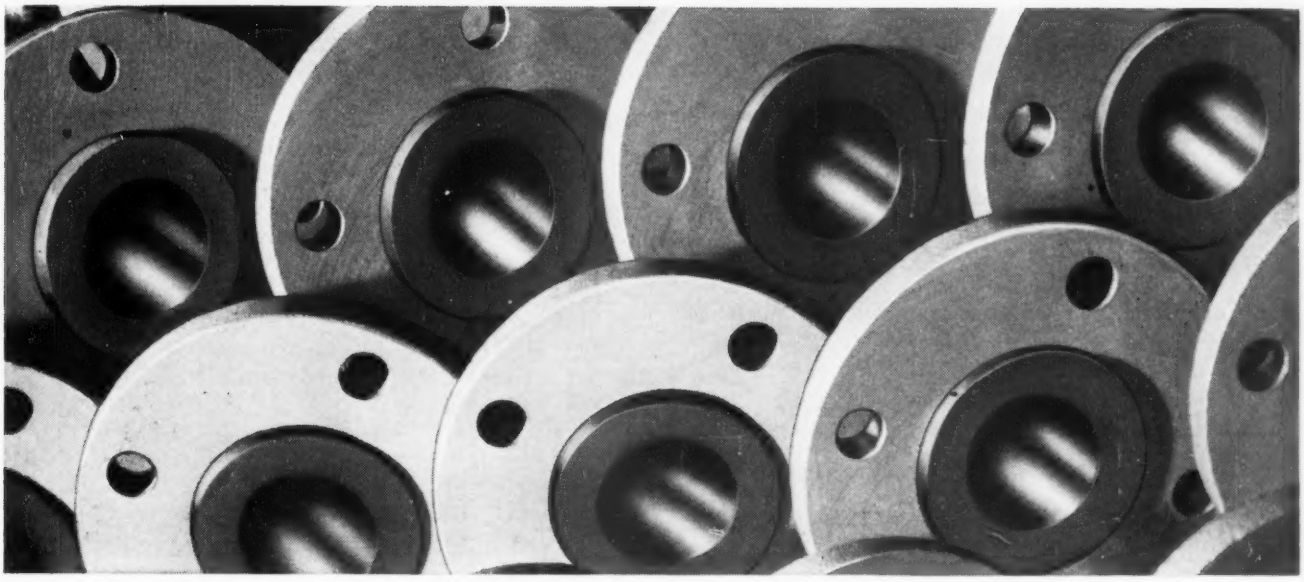
ELECTROLESS NICKEL

We will be glad to discuss
the use of our process
on your parts

THE VEA CHEMICAL CO.

MANUFACTURING CHEMISTS TO THE METAL FINISHING INDUSTRY
1217 MAIN AVENUE • CLEVELAND 13, OHIO • PROSPECT 1-2751

DOW



You can see why

SARAN LINED PIPE

GIVES LONG, TROUBLE-FREE SERVICE

It's made of corrosion-resistant saran pipe swaged into steel for extra rigidity and strength . . . cuts downtime losses conveying corrosive liquids.

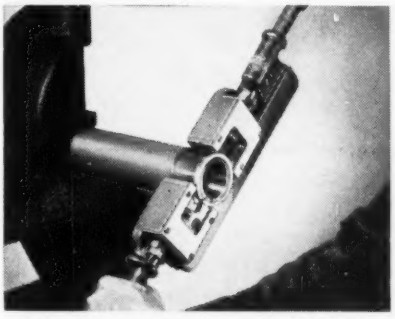
Now you can convey chemicals and many other corrosive liquids without worrying about costly shutdowns due to corrosion. For saran lined pipe, fittings and valves are corrosion-resistant . . . form snug, leakproof joints . . . won't burst under pressure.

They're easily and inexpensively installed because they can be cut and threaded in the field with any standard pipe fitter's tools. Their rigidity means that few supporting members are needed.

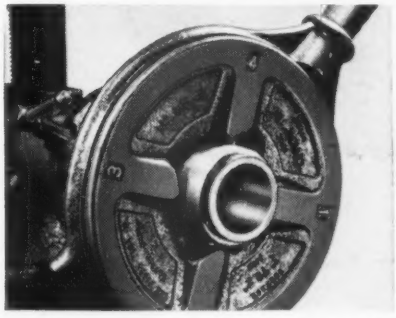
Saran lined pipe, fittings and valves have a proved record in industry of bringing long trouble-free service. If your operation requires superior resistance to most chemicals and solvents, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, Department SP527C, 2415 Burdette Avenue, Ferndale 20, Michigan.

RELATED SARAN PRODUCTS—Saran rubber tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

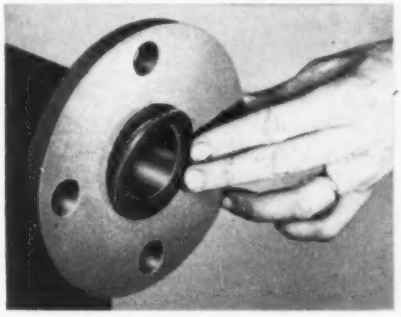
Saran Lined Pipe Can Be Fabricated Right in the Field!



A Beaver Cutter cuts away the end of the steel pipe so that $\frac{1}{16}$" of the saran lining is extended. This assures a tight seal after a flange is applied and connected with another flange.



A ratchet type thread cutter makes the standard threads after the Beaver Cutter has been used. A flange is then attached and the saran liner filed so its ends are flush with the flange.



A half gasket is used in each flange or whole one can be used in one of the flanges. Then the flanges are joined. The resulting joint is snug, completely airtight and leakproof.

Saran Lined Pipe is Manufactured by The Dow Chemical Company, Midland, Michigan

you can depend on DOW PLASTICS

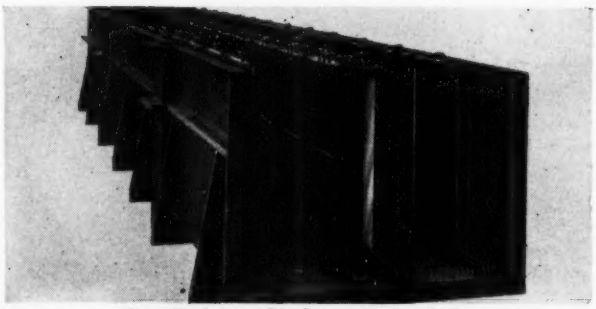
DOW

• A remarkable advancement in electroplating, Diaphragm Systems, engineered and installed by ARco have created a new high standard in plating production and quality.

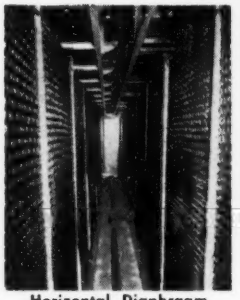
Simply, economically installed, Diaphragm Systems efficiently segregate the anolyte from the catholyte through canvas barriers between anode and cathode compartments.

This ARco electroplating method, combined with ARco Rubber Lined Tanks and planned solution circulation, filters metallic insolubles from outside sources.

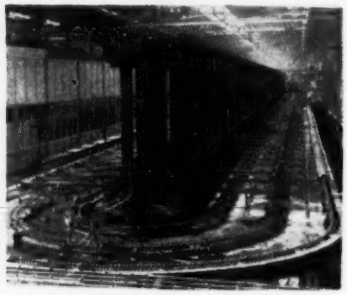
To reduce costly buffing due to roughness . . . prevent rejects resulting from thin spots . . . have an ARco engineer show you how simply Diaphragm Systems can save time, materials . . . and customers . . . for you.



Two Work Lane Diaphragm Plating Tank



Horizontal Diaphragm Installation



Vertical Diaphragm Installation

For uniformly high quality and economy in plating . . .

DIAPHRAGM SYSTEMS *and* RUBBER LINED TANKS *by* ARco

• ARco fabricated and insulated Diaphragm Plating Tank, return bend type.

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"Diaphragm Tanks Promote Plating Progress." This explanatory, illustrated booklet is yours without obligation. Send for it today!
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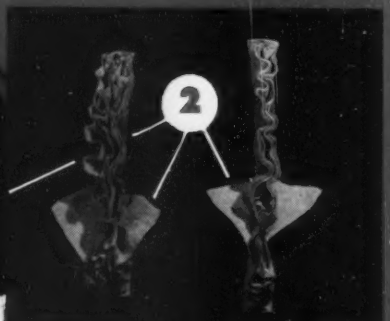
No other Buff...

has all these advantages

CODMAN NON-FRAY BUFFS

1. THICKNESS OF RING VARIES DENSITY.
2. TRAILING ENDS — (Safety)
3. NON-COMPRESSIBLE CONSTRUCTION
4. NON-METALLIC CENTER — (No Shaft Scoring)



OPEN FACE CLOSED FACE

Available-Closed or Open Face Ventilated, Of Course, When Necessary

F. L. & J. C. CODMAN COMPANY

ROCKLAND, MASSACHUSETTS

the greatest name in buffs for over 55 years

BRANCH OFFICES — PHILADELPHIA, DETROIT, LOS ANGELES, INDIANAPOLIS, GRAND RAPIDS

the finest strippers of all

are in NORTHWEST drums

"Step right up Gentlemen, you ain't seen nuttin' yet."

And you haven't until you've seen Northwest's Strippers in action.

These high-speed babies really "peel" organic finishes. Built to cope with all types of paints on metals or plastics — Northwest Strippers give you a clean surface ready for repainting in one run-through.

Northwest Strippers are Safe — no fire hazard, no odor, no fumes, non-toxic.

Northwest Strippers are Sure — parts are fully cleaned — metal surfaces are unharmed — long life is assured — economy is proven.

Northwest Strippers are Soluble — film is converted into a form which can be rinsed off with water spray — contains no chemicals which can't be flushed through sewers.

Call your Northwest Cleaning Specialist for the right stripper to do any job.

Remember — YOUR COST PER FINISHED ARTICLE IS THE TRUE COST OF YOUR CLEANER.

LO HI pH

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

pioneers in pH cleaning control serving you since '32

Whether your operation requires 200 or 12,000 ampere output . . . manual control or automatic regulation . . .

Crown RECTIFIERS

offer you these . . .

MONEY-SAVING FEATURES!

LOW INITIAL COST . . . Simple yet rugged design of the CROWN rectifier has reduced initial costs. Standardization and resulting manufacturing economies pass added savings on to you.

FLEXIBILITY . . . Two or more CROWN rectifiers can be connected in series for higher voltages, parallel for higher current, or series-parallel to increase total output. Multiple operation of units is simple when work load changes. Additional units may be added as power demands increase.

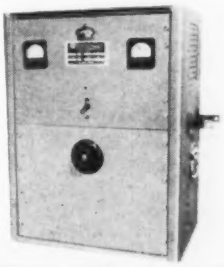
SPECIAL DOWN-DRAFT VENTILATION . . . High pressure fan at bottom of unit draws air down from top to bottom. Guarantees even air distribution and perfect stack cooling. No dirt picked up from floor. Unit stays clean longer. Easily connected to outside air source, if necessary

STANDARD REPLACEMENT PARTS . . . Because of a high degree of standardization, a complete parts list of all components accompanies each CROWN rectifier. Any replacement part may be obtained within 24 hours anywhere in the United States.

EASE OF INSTALLATION . . . No special foundations or expensive accessories required. No separate panels to wire, no concrete bases to be poured. Unit comes factory pre-tested. Just unpack, connect AC line and DC bus, and rectifier is ready for operation.

REDUCED MAINTENANCE COST . . . No moving parts, except ball bearing fan motor, cuts maintenance costs. Only maintenance required is removal of dust on rectifier plates.

These Features plus the quality of materials and the careful workmanship that goes into each unit, make CROWN RECTIFIERS the *most economical you can buy*.



TAP-SWITCH CONTROLLED RECTIFIER, Model P6-250-8. DC output 0 to 6 volts, 0 to 250 amperes.

TAP-SWITCH CONTROLLED RECTIFIER, Model P6-2000T22F. DC output 0 to 6 volts, 0 to 2000 amperes.

MAGNETIC AMPLIFIER CONTROLLED RECTIFIER, Model RP12-6000CC. DC output 3 to 12 volts, 600 to 6000 amperes.

REMOTE TAP-SWITCH CONTROL RECTIFIER, Model P9-12,000-T66F. D.C. Output 0 to 9 volts, 0 to 12,000 amperes continuous.

TAP-SWITCH CONTROLLED RECTIFIER, Model P12-4000T44. DC output 0 to 12 volts, 0 to 4000 amperes.

For more specific and technical information concerning your application, write Crown Chemical and Engineering Co. today . . . or contact your nearest authorized distributor.

Crown SELENIUM RECTIFIERS

***Manufactured by* CROWN CHEMICAL AND ENGINEERING CO. • 4722 Worth Street, Los Angeles 63, California**

CROWN RECTIFIER DISTRIBUTORS

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R. W. RENTON & CO., Cleveland, Ohio • SOMMERS BROS. MFG., St. Louis, Mo. • GEORGE V. MORRIS, Philadelphia, Pa.
W. M. FOTHERINGHAM, Buffalo, New York • MITCHELL EQUIPMENT CORP., Sylvania, Ohio

MURRAY-WAY the automatic way / the economical way / the better way

to POLISH . . . BUFF . . . GRIND . . . FILTER

Whatever your job . . . whatever your problem . . . Murray-Way automatic equipment will do that job better and more economically.

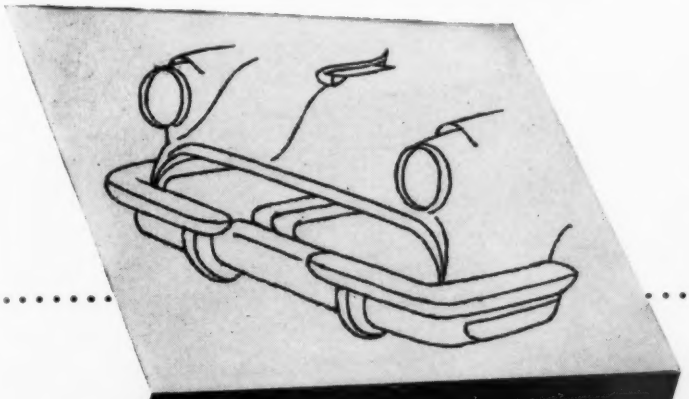
These are just a few illustrations of Murray-Way's success in beating production cost with the finest automatic equipment available.

You can depend on Murray-Way engineering, Murray-Way experience, Murray-Way equipment to solve your production problems.

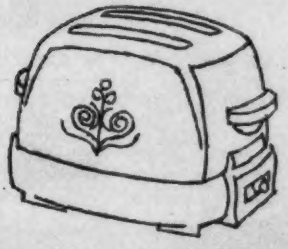
A. Micro-Polish—Continuous Strip Polishing Installation
B. Vertical-Platen Conveyor
C. Horizontal-Platen Conveyor
D. #51 Universal Polishing Head —One of Several Standard Polishing Heads
E. The Automatic, Self-Cleaning, Compact Filter
F. #72 Series Belt Polishing Head
G. Indexing Dial Table
H. Six Micro-Polish Units in Series

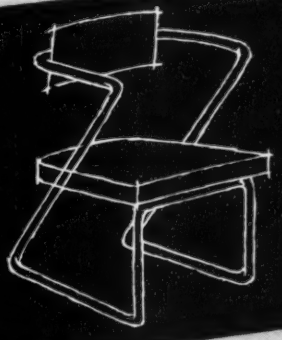
P. O. Box 180, Maple Road, E.
Birmingham, Michigan

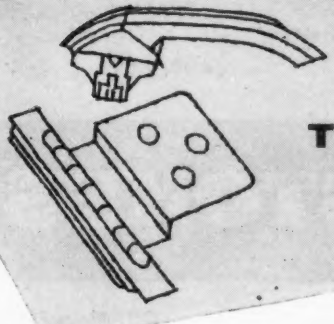
MURRAY WAY CORPORATION



HARSHAW
electroplating
CHEMICALS
and
ANODES







nickel plating

... still and barrel ... nickel anodes—all commercial grades and sizes ... anode bags ... single nickel salts—nickel chloride ... nickel carbonate ... nickel fluoborate ... boric acid.

chromium plating

... pure "Krome Flake" 99.8% CrO_3 ... sulphates less than .10% ... lead, tin-lead and antimony-lead anodes.

copper plating

... copper ball anodes ... Rochelle Salts ... sodium and copper cyanides ... copper sulfate ... copper fluoborate.

cadmium plating

... ball and cast cadmium anodes ... cadmium oxide ... sodium cyanide ... cadmium fluoborate.

tin plating

... cast tin anodes ... sodium stannate ... stannous sulfate ... tin fluoborate ... acid tin addition agent.

zinc plating

... ball and cast zinc anodes ... sodium and zinc cyanide ... zinc sulfate ... zinc fluoborate.

lead plating

... cast lead anodes ... lead fluoborate.

silver plating

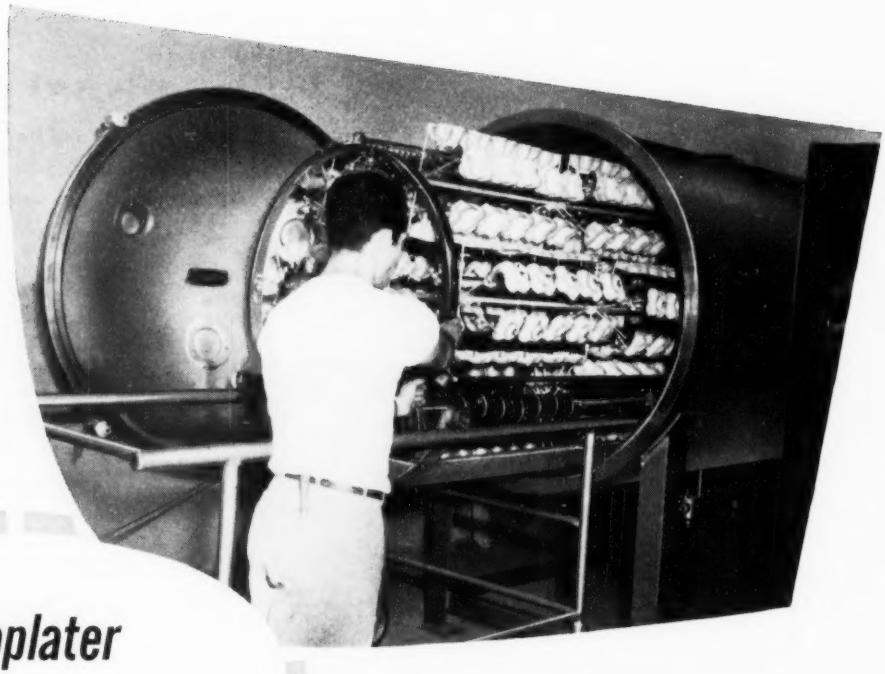
... silver cyanide.

THE HARSHAW CHEMICAL COMPANY

Cleveland 6, Ohio

Chicago 10, Ill. • Cincinnati 13, Ohio • Detroit 28, Mich.
Houston 11, Texas • Los Angeles 22, Calif. • Philadelphia 48, Pa.
Pittsburgh 22, Pa. • New York 17, N. Y.

A rack with baby bottle warmers is loaded into a Stokes vacuum plating unit at Specialized Plating Company. Vacuum plated pieces have a bright, durable finish as shown in the completed metal products above and below. Vacuum plating can also be applied to glass, plastics, textiles, and paper, giving the custom finisher broad opportunities.



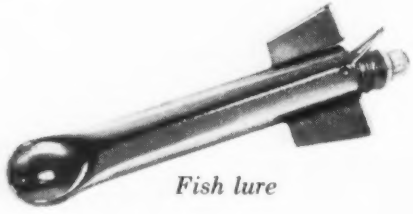
Custom Electroplater Cuts Costs 50% through Vacuum Plating

Specialized Plating Company of Los Angeles, California, estimates that vacuum plating saves them 50 to 60% over electroplating on typical parts such as those shown. This custom finishing firm uses a 48-inch Stokes vacuum plating unit to apply functional and decorative coatings to a broad range of metal parts.

Lamp base

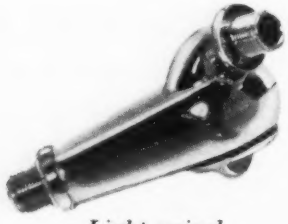
Vacuum plating provides a low-cost, durable, non-tarnishing finish on metals. Endurance—by salt-spray tests—is up to ten times that of electroplated finishes. The process deposits a lustrous aluminum coating on all types of die castings, steel stampings, aluminum spinnings and slush metal. Polishing and buffing operations are eliminated.

Stokes makes vacuum plating units in 24, 36, 48 and 72-inch sizes and has a fully equipped laboratory where your samples can be plated. Through the Stokes Advisory Service, complete engineering advice on production and plant lay-out is at your disposal. Write for your copy of an authoritative illustrated brochure on this low-cost finishing method.



Fish lure

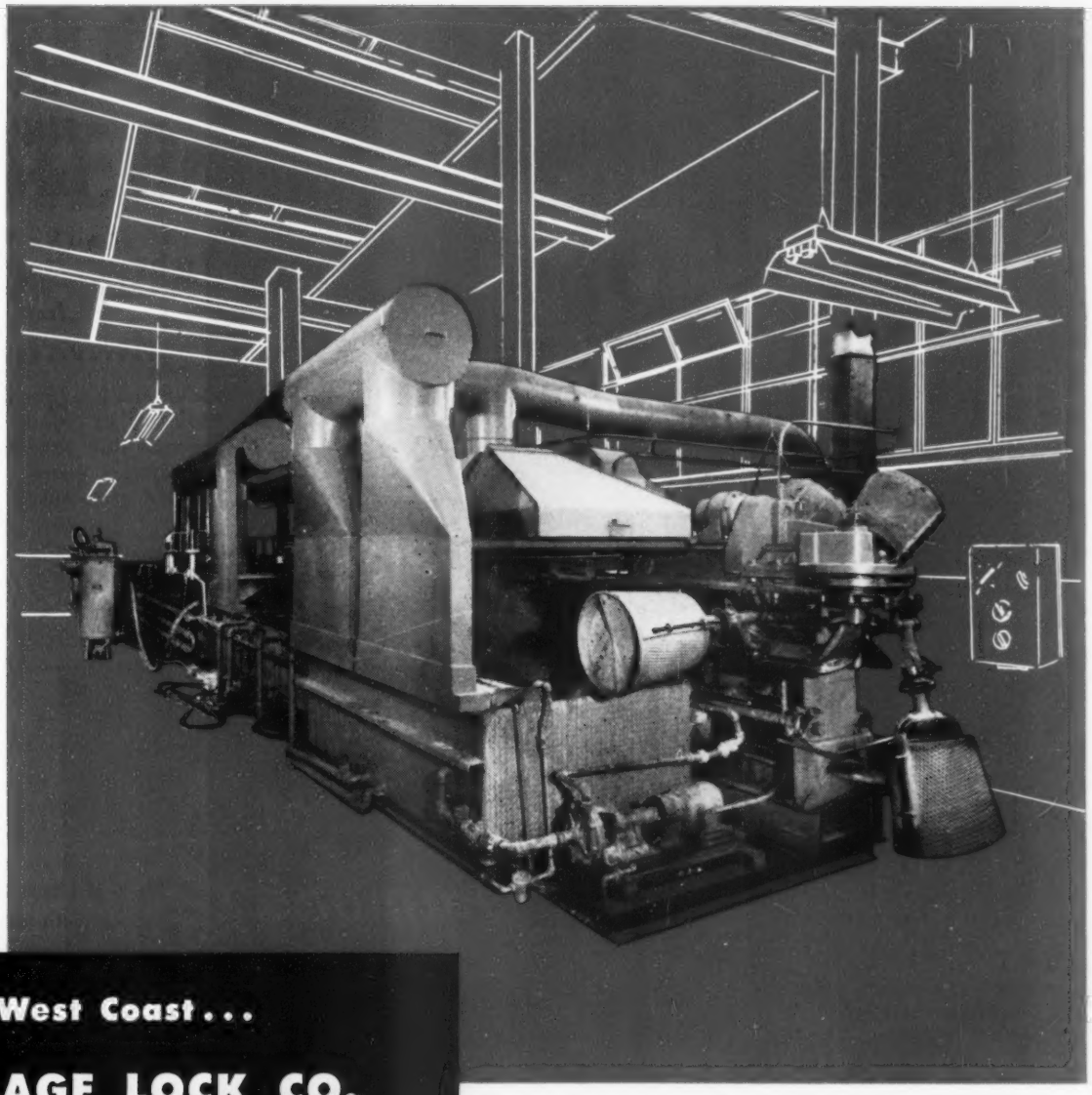
F. J. STOKES MACHINE COMPANY
PHILADELPHIA 20, PA.



Light swivel

STOKES

OFFICES IN PRINCIPAL CITIES
REPRESENTATIVES THROUGHOUT THE WORLD



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STEVENS

Automatic Equipment!

"We get a durable finish . . . better results . . . with our Stevens Automatic Barrel Plating Installation." That's the report of Schlage Lock Company of San Francisco.

They produce locks and other types of builders' hardware. In every case, precision is absolutely necessary to assure the dependability for which Schlage is famed.

That's where Stevens Automatic Barrel Plating Installation pays its way!

Automatic Zinc Barrel Plating assures durability . . . while it gives HIGH PRODUCTION. A Stevens automatic barrel machine again supplied the answer to a manufacturer's production problem.

Call your Stevens Sales Engineer for help with your metal finishing problems. Or write direct. FREDERIC B. STEVENS INC., DETROIT 16, MICHIGAN.

Visit us at the A.E.S. Convention, Cleveland, Ohio, June 20-23.

FREDERIC B.
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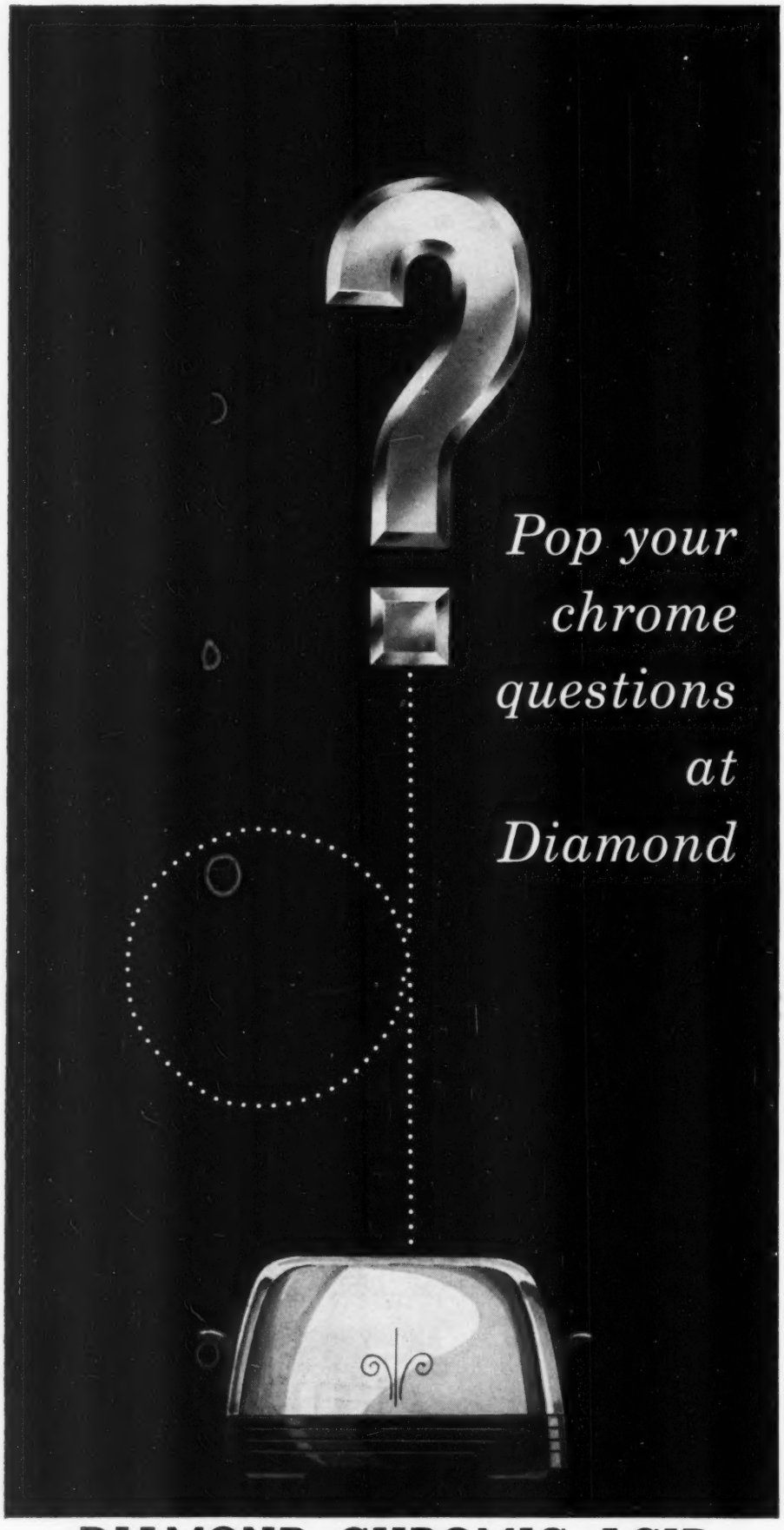
INCORPORATED
EVERYTHING FOR METAL FINISHING
DETROIT 16, MICHIGAN

BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN • DAYTON



DIAMOND CHROMIC ACID

See DIAMOND at the

INDUSTRIAL FINISHING EXPOSITION

Booths 307-308-309
Cleveland, Ohio
June 20-23

Here at DIAMOND we are all set to pop up with answers to almost any question about chrome plating that comes along. Our Chromium Chemicals Division has experts that do nothing else. And they do it without charge.

Our technical background comes from broad experience. We are in the chrome business up to our ears. For instance, we import the ore, make the soda ash and from there on, control every process in the making of DIAMOND chromic acid . . . extra assurance of uniform quality that helps you to get more uniform, more profitable results.

Nine warehousing points and nine sales offices spread across the country assure you fast service and uninterrupted supply. DIAMOND ALKALI Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS ®

ANNOUNCING: New VS-3 HONITE Barrel Finishing Machine

MORE CONVENIENT...EASIER TO MAINTAIN...LOWER COST

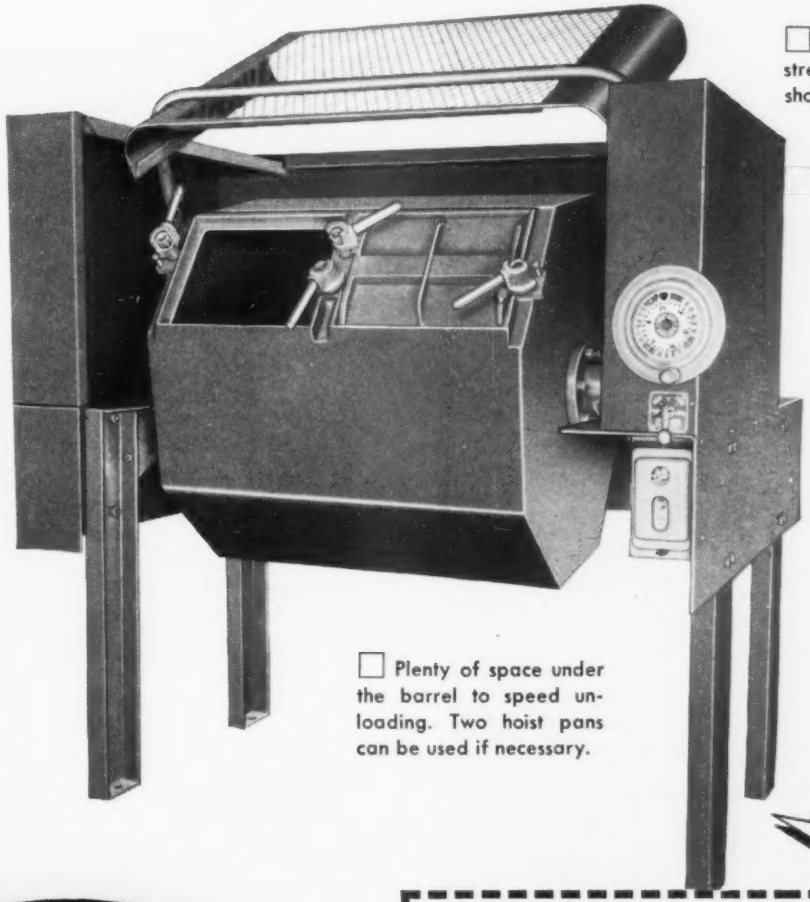
Here's the newest addition to the HONITE line of barrel finishing machines! More convenient . . . easier to maintain . . . lower cost, yet it retains *all* of the same precision construction features of established DV-3 and DV-5 models. It's designed with your needs in mind. It meets the most rigid safety requirements. With the all-new HONITE Barrel Finishing Machine, you have a choice of three motors; the 1½ h.p., for normal applications, the 2 h.p. for all but the heaviest jobs, the rugged 3 h.p. for super heavy-duty requirements. Note that the motor, speed reducer, speed changer and magnetic brake are mounted as a single compact unit, located well away from water and dirt, and completely protected from accidental damage by hoist pans, hoists and swinging objects.

☐ Pivoted safety gate —no slides or rollers to stick or jam.

☐ All lubrication points are open and accessible.

☐ Handy height controls, switches and speed changer located at right side of barrel. No stooping — no stretching.

☐ Cylinder can be removed from the front without disassembly.



☐ Steel frame absorbs drive stresses without transmitting shock to supports.

☐ Oversize pillow blocks and self-aligning bearings carry full loads of steel burnishing media.

☐ Chain guard covers drive even when safety gate is raised.

☐ Shafts are jig-bored for cylinder mounting to insure alignment on axles within .005".

☐ Plenty of space under the barrel to speed unloading. Two hoist pans can be used if necessary.

WANT MORE INFORMATION?

Honite® BRAND

Minnesota Mining and Mfg. Co.
Dept. MF-35, St. Paul 6, Minn.

I'd like to talk to a HONITE Methods Engineer about the new HONITE Barrel Finishing Machine.

Name.....Title.....

Company.....

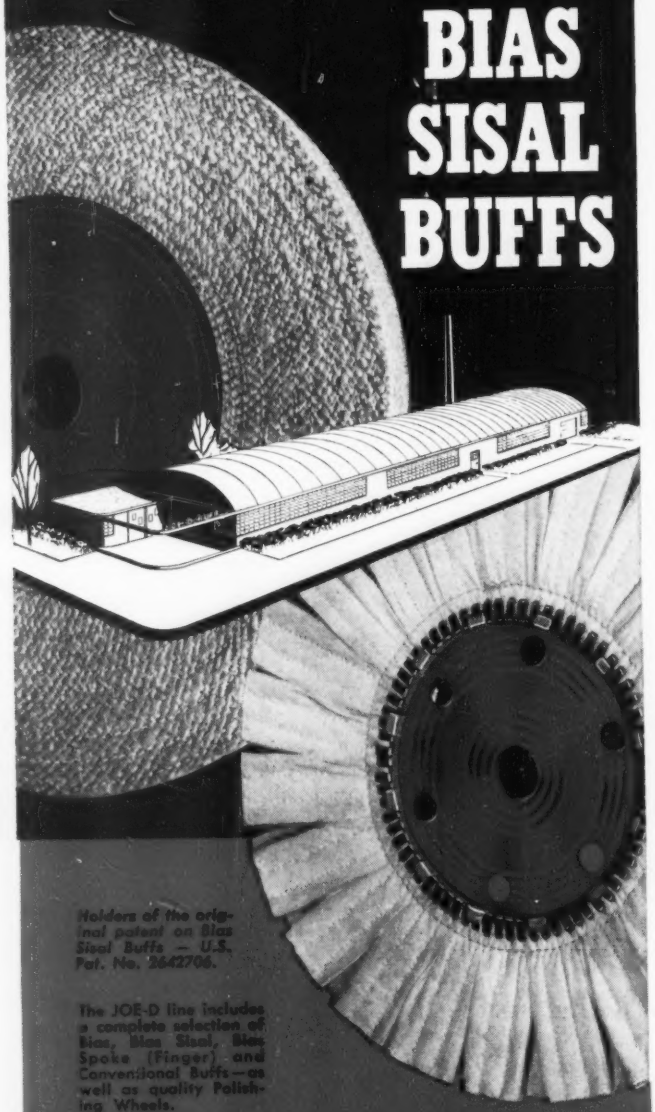
Address.....

City.....Zone...State.....

Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P.O. Box 757, London, Ont. Export: 99 Park Ave., New York City. Makers of "Scotch" Pressure-Sensitive Tapes, "Scotch" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.

The "House that Sisal Built"

JOE-D ... Originators of BIAS SISAL BUFFS



Holders of the original patent on Bias Sisal Buffs — U.S. Pat. No. 2642706.

The JOE-D line includes a complete selection of Bias, Bias Sisal, Bias Spoke (Finger) and Conventional Buffs—as well as quality Polishing Wheels.

Since its founding, the JOE-D Buff Company has specialized in Sisal—constantly experimenting and testing ways to give you faster-cutting, longer-lasting Sisal Buffs. Made of the finest quality imported sisal, specially woven and processed for guaranteed fray-proof performance . . . . never a loose end to whip or scratch . . . always an even nap to hold compound and provide better color. For every Sisal Buff requirement, specify JOE-D, the original—and still America's finest—Bias Sisal Buffs!

ATTENTION JOBBERS: Some choice territories still available. Write TODAY!

the JOE-D Buff Company

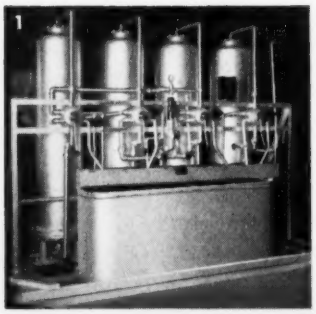
SANDWICH, ILLINOIS • TELEPHONE 2171

FINISH IT . . .

FASTER — BETTER — CHEAPER

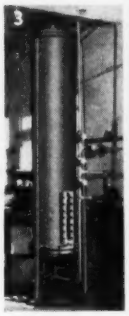
1878 Barnstead with WATER DEMINERALIZERS

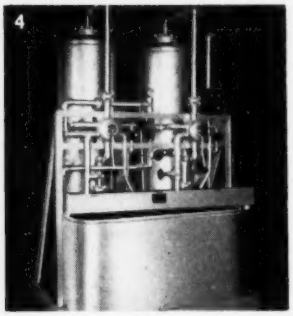
— Better Plating, better Finishing with MINERAL-FREE WATER



#1 FOUR-BED
Capacities up to 2500 gallons per hour. Shipped complete, ready for water line.

#2 MODEL BD 2
5 to 25 gallons per hour under pressure. Connects to any tap.





#3 MIXED-BED
Capacity of 500 gallons per hour. Low cost, 5c for 1000 gallons.

#4 TWO-BED
1000 gal/hr of pure water for plating, anodizing, etc.

Partial List of Barnstead Demineralizer Users

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Ford Motor Company
Sarkes Tarzian
Raytheon Mfg. Co.
Radio Corp. of America
Hard Chromers Inc.
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BARNSTEAD ALSO MANUFACTURES A COMPLETE LINE OF DISTILLED WATER STILLS

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1878 TRADE MARK REG. U.S. PAT. OFF.

Barnstead STILL & STERILIZER CO.

FIRST IN PURE WATER SINCE 1878

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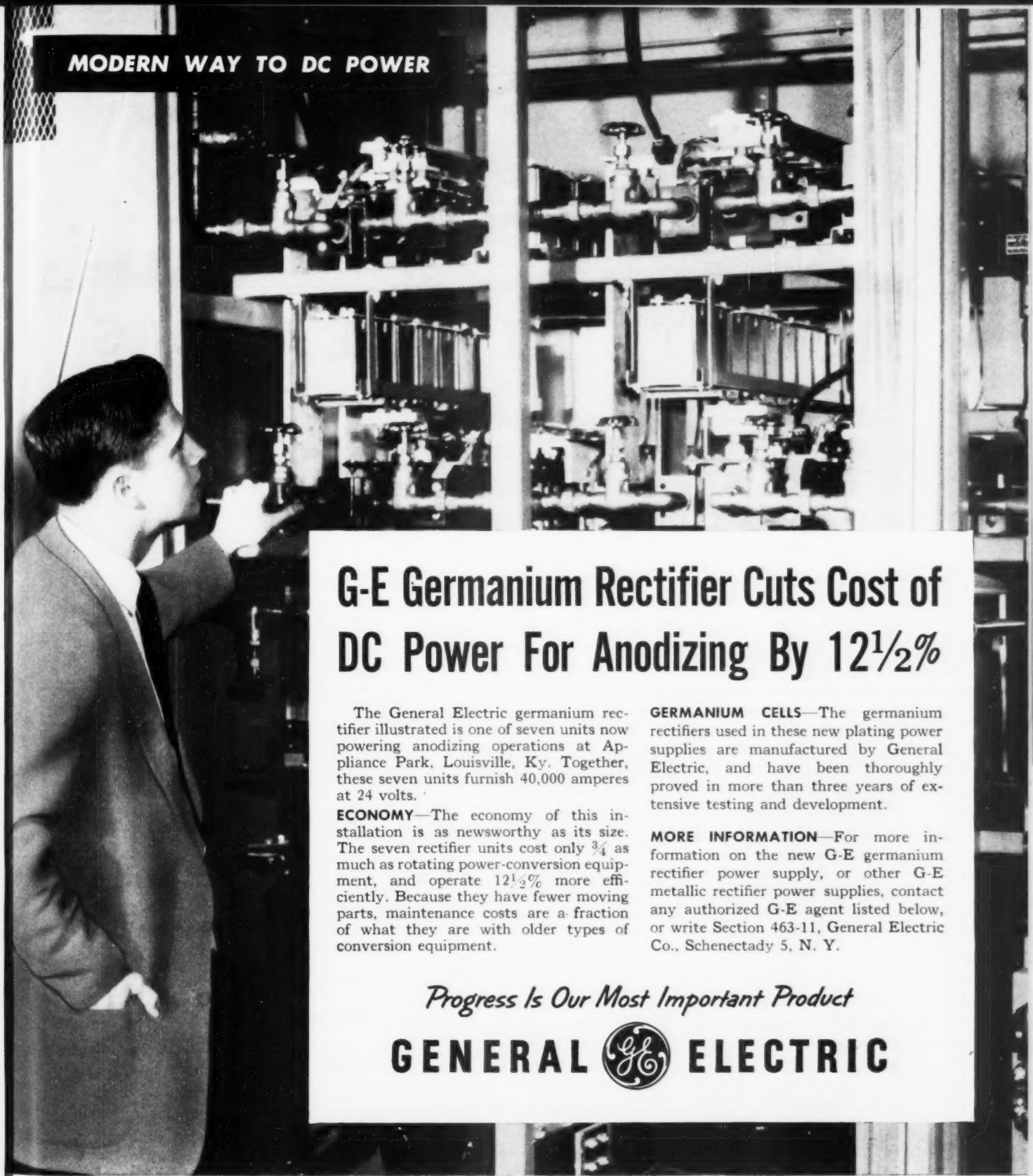

G-E Germanium Rectifier Cuts Cost of DC Power For Anodizing By 12½%

The General Electric germanium rectifier illustrated is one of seven units now powering anodizing operations at Appliance Park, Louisville, Ky. Together, these seven units furnish 40,000 amperes at 24 volts.

ECONOMY—The economy of this installation is as newsworthy as its size. The seven rectifier units cost only ¾ as much as rotating power-conversion equipment, and operate 12½% more efficiently. Because they have fewer moving parts, maintenance costs are a fraction of what they are with older types of conversion equipment.

GERMANIUM CELLS—The germanium rectifiers used in these new plating power supplies are manufactured by General Electric, and have been thoroughly proved in more than three years of extensive testing and development.

MORE INFORMATION—For more information on the new G-E germanium rectifier power supply, or other G-E metallic rectifier power supplies, contact any authorized G-E agent listed below, or write Section 463-11, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

G-E PLATING POWER SUPPLIES ARE SOLD BY THESE AUTHORIZED AGENTS:

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M. E. BAKER CO., Cambridge, Mass.
BELKE MFG. CO., Chicago, Ill.
THE CHEMICAL CORP., Springfield, Mass.
CLEVELAND ELECTRIC CO., Atlanta, Ga.
CONNECTICUT ELECTRIC EQUIPMENT CO., INC. Meriden, Conn.
ENTHONE CO., New Haven, Conn.
FITZPATRICK ELECTRIC SUPPLY CO., Muskegon, Mich.
W. M. FOTHERINGHAM CO., Buffalo, N. Y.
GENERAL ELECTRIC SUPPLY CO., Cleveland, Ohio
FRED GUMM CHEMICAL CO., Kearny, N. J.
J. & H. ELECTRIC CO., Providence, R. I.
LASALCO, INC., St. Louis, Mo.
LEA MANUFACTURING CO., Waterbury, Conn.
WILLIAM LYNN CHEMICAL CO., INC., Indianapolis, Ind.
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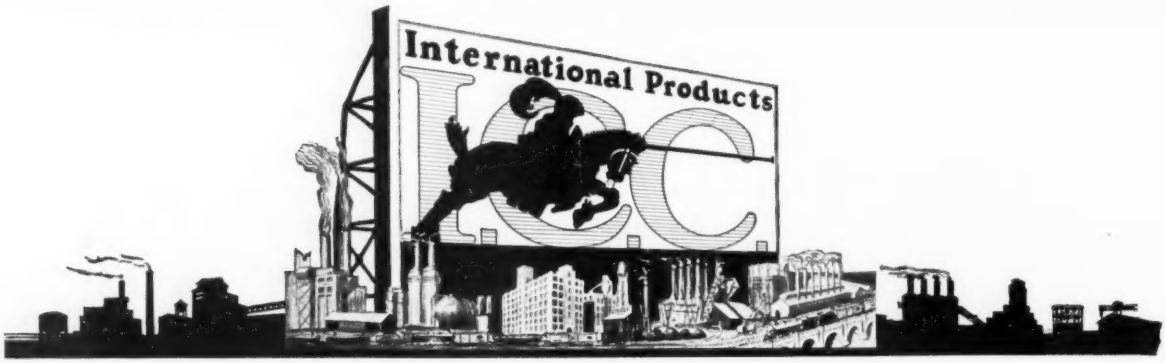
J. C. MILLER CO., Grand Rapids, Mich.
GEORGE L. NANKERVIS CO., Detroit, Mich.
THE REYNOLDS CO., Philadelphia, Pa.
STANDARD PROCESS CORP., Chicago, Ill.
STANDARD WHOLESALE SUPPLY CO., Las Vegas, Nev.
UDYLITE, Detroit, Mich.



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FOR

ALL METALS

SOAK TANK • ELECTROPLATING • WASH TANK

VITREOUS ENAMELING • STRIPPING, ETC.

OILS AND WATER SOLUBLES

FOR

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INTERNATIONAL CHEMICAL COMPANY, INC.

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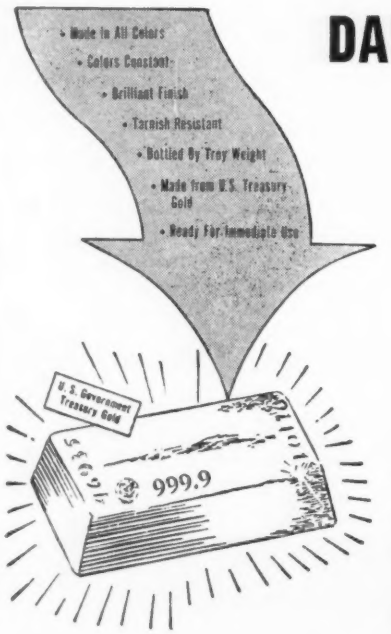

DAVIS-K GOLD PLATING SOLUTIONS

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67% POTASSIUM GOLD CYANIDE SALTS

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LUSTROUS WHITE RHODIUM SOLUTION

THE ONE OUTSTANDING DEVELOPMENT IN GOLD PLATING DURING THE PAST QUARTER CENTURY

DAVIS-K

ONE OPERATION

Antique Gold Solution

TANK RHEOSTATS: We are pleased to announce our variable type tank rheostats which are specially designed for precious metal plating.

DAVIS-K SERVICE: Our service today with its newly expanded facilities is fast and efficient. We are fully equipped to reclaim your old gold and rhodium solutions. Phone or write your precious metal problems. We welcome them!

"Where Glittering Elegance Reflects Lasting Quality."

DAVIS-K PRODUCTS CO.

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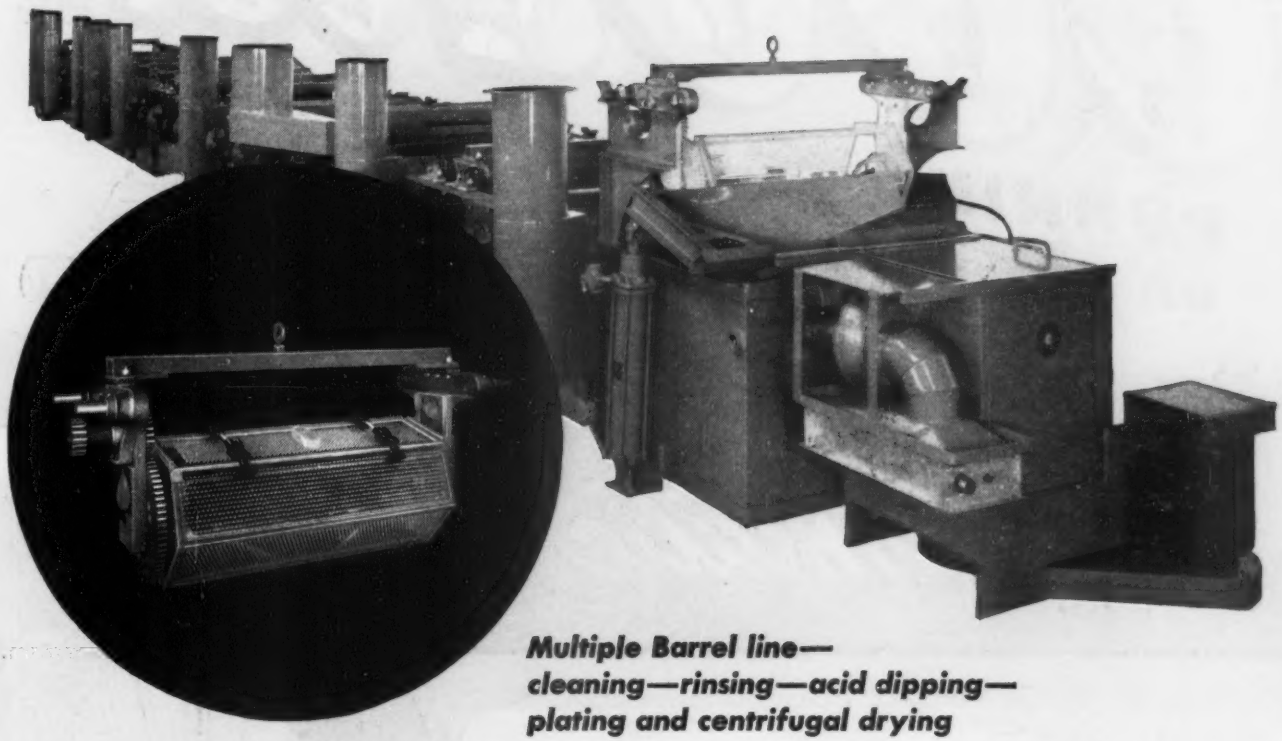
CROWN PLATING BARRELS



Multiple Barrel line—
cleaning—rinsing—acid dipping—
plating and centrifugal drying

CROWN LUCITE CYLINDERS

Can be operated through the entire cycle
cleaning—rinsing—acid dipping—and plating solutions.

Whether your production requires a single barrel
or a multiple set up for cleaning, rinsing, acid dipping, and
plating, there are Crown barrels to fit the job.

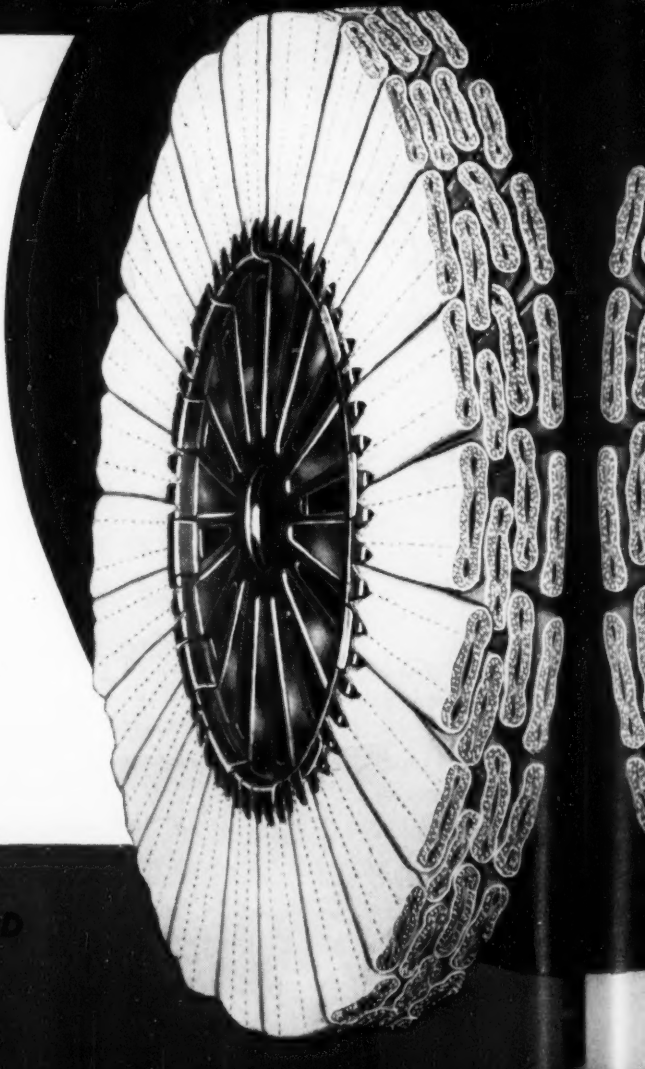
Write for complete details

CROWN RHEOSTAT AND SUPPLY COMPANY
3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

COOLest

RUNNING BUFF on the MARKET

Automatic UNITS



SELF-COOLING DESIGN

Special unit design circulates air throughout every fibre, even in high-speed operation

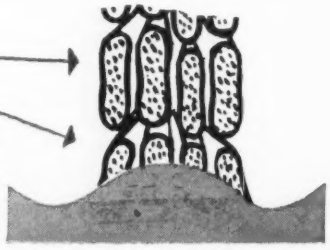
COOLER RUNNING

Air-cooled Permanent Center prevents burning or discoloration even at highest speeds

FLEXIBLE

Individual "Units"

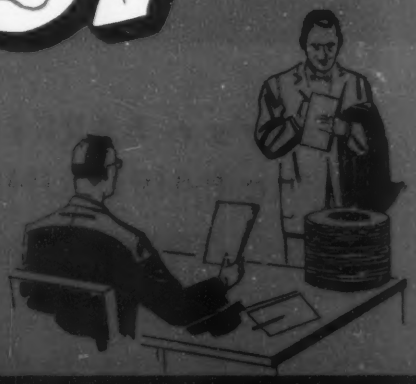
follow every contour—over high spots and into crevices—give top notch efficiency on all irregular and contoured surfaces



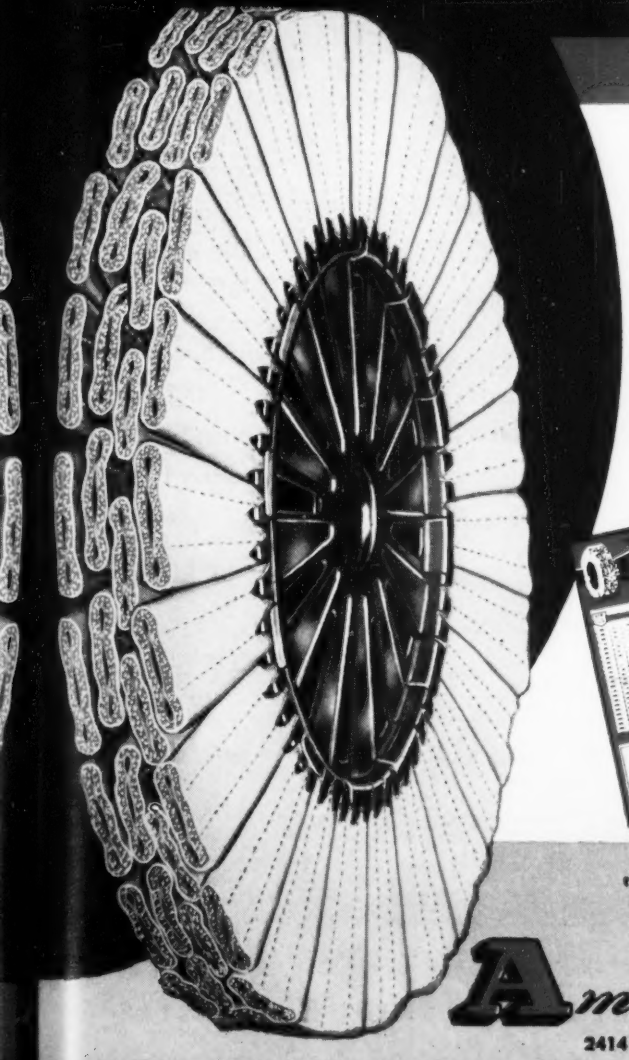
***VERSATILE** HEAVY-DUTY BUFF for FAST, HARD CUTTING of BRASS, STAINLESS STEEL, CARBON STEEL and ALUMINUM*

HOT-est

SELLING BUFF
in the INDUSTRY



SISAL BUFF



"HOT" idea for "COOL" savings

Fast-cutting Sisal and safe, higher speeds reduce finishing time and costs

"Permanizing" process locks Sisal Fibres together . . . eliminates loose ends and scratches . . . will not fray

Cloth-wrapped Sisal units cut and color in one operation . . . get work done in fewer passes . . . use less buffing compound

Also available with patented "CENTERLESS" construction.

FREE! Handy "BUFF SELECTOR" WALL CHART
instantly tells you the right buff . . . right size . . . right speed for every job! Sent to buff users only. *Write for yours today!*

"For the Job That's TOUGH, Use an AMERICAN BUFF"

AUTOMATIC BUFF CO. DIVISION OF

American Buff Company

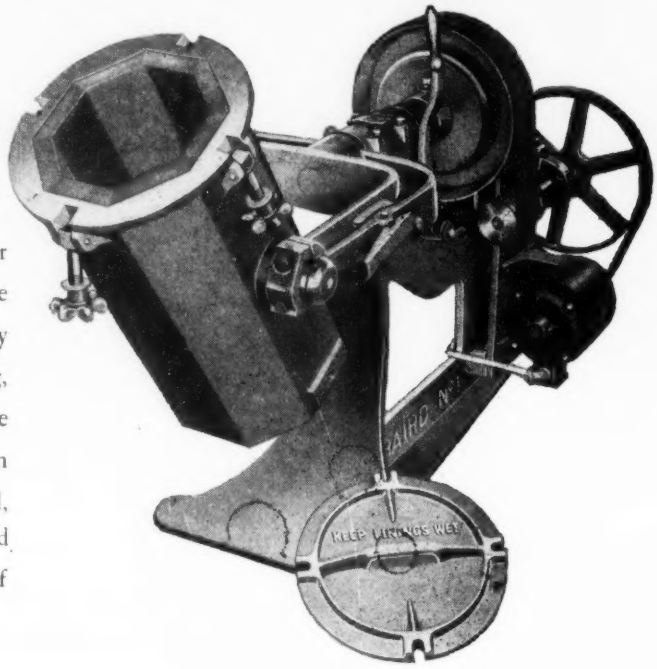
2414 S. La Salle St. Chicago 16, Illinois CAlumet 5-1607

ASK **BAIRD** ABOUT IT!

TUMBLING BARRELS FOR MORE THAN 50 YEARS

There's a BARREL in the BAIRD LINE to suit your *Specific Job*

Defense production not only calls for a greatly increased number of barrels, but also for a wide variety of types. The Baird line of Tumbling Equipment and Barrels includes practically every type required for Burnishing, Degreasing, Deburring, Drying, Heating, Japanning, Cleaning and Coating. Barrel shapes are round, bottle-shaped, octagonal, polygonal . . . closed or open mouth . . . cast iron, fabricated steel, sheet brass, Monel, Everdur, stainless steel or wood . . . and metal barrels may be lined with wood, rubber, etc., also with inner shell for introduction of live steam.



Baird manufacture of Tumbling Equipment covers well over a half century . . . and a wealth of experience . . . from the days of belt drive to modern direct motor with an added motor for automatic tilting, if desired.

We illustrate two types . . . (above) No. 1 Baird Single Ball Burnishing Machine, motor drive with tilting, rolling, lined barrel . . . (left) Baird Model D Single Oblique Tilting Tumbler, motor driven. Manual tilting, polygonal, round corner bottom sheet metal barrel. Automatic tilting, if desired.

If you have a finishing problem, send for bulletins. Ask Baird about the best method for your specific job.

WRITE DEPT. MF.

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

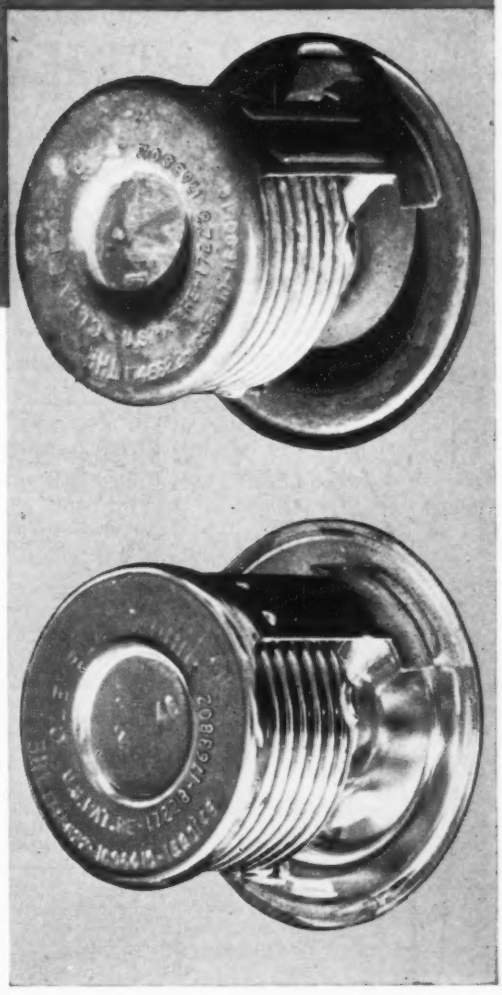
6BA52

Battelle

Chemical Polishing

a process that "brilliantizes"

smooths as it brightens,
brings out basic luster of metal...
chemical polishing will not etch!



Chemical Polishing is a dollar-saver in the bulk finishing of parts of intricate shapes, or of such small size that wheel-polishing is impractical.

The thermostat at right is typical—small, with grooves, depressions, and sections not accessible to buffing. Chemical Polishing produced a satisfactory, lustrous finish at low cost.

Hundreds of parts in many lines are similarly adaptable to this cost-cutting. As many as four steps have been eliminated in finishing an item. A chemical-polished surface can be plated over without other treatment.

These metals can be processed: brass, copper, nickel-silver, Monel, nickel, aluminum. Chemical Polishing requires only a tank and heating element. It is simple to install—operate—control.

For more information about Chemical Polishing write any of these distributors—all fully equipped to help you technically.

Ask for the new folder, FINISHING—WITH A PROFIT, which describes several Battelle-developed processes.

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- P. B. Gast and Sons
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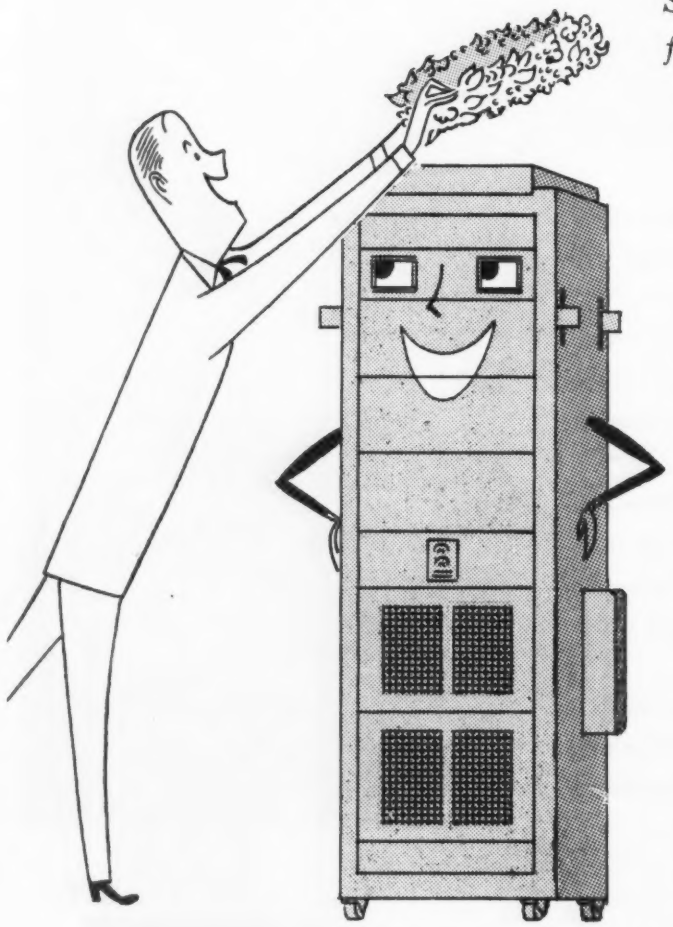

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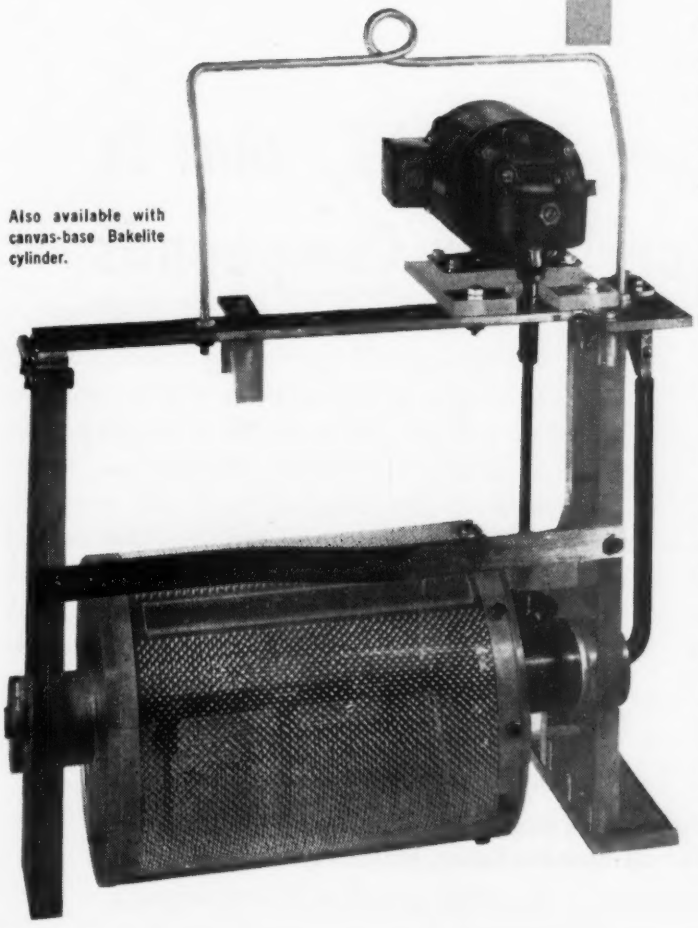
Whatever the process—whatever the grade or type of material—you can plate the small lots with much greater uniformity, and do it in far less time at lower cost with a Utility Barrel Plater. No other equipment in its price range can match it!



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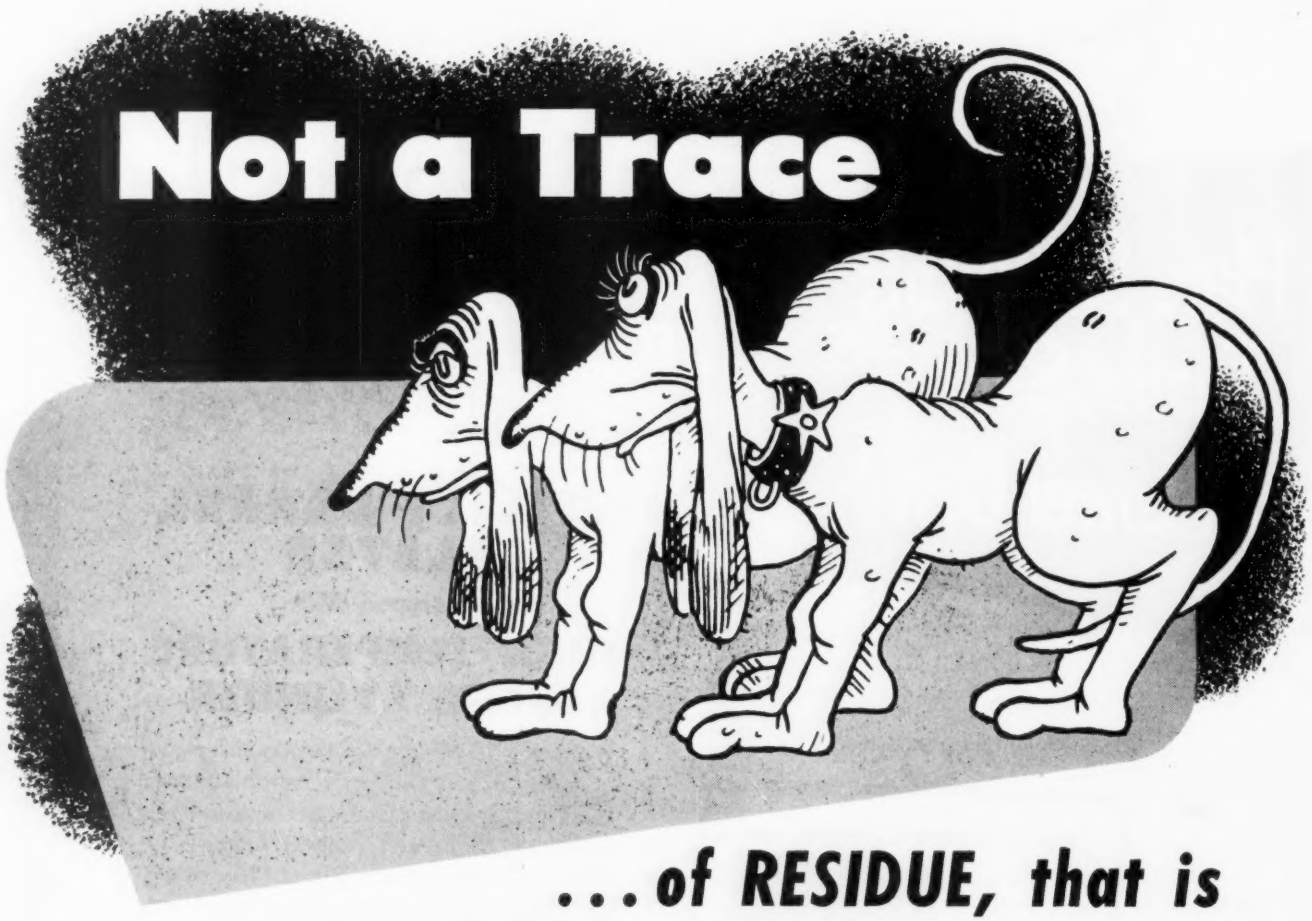

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Residue vanishes in a water rinse . . . burnished surfaces are left clean, bright, and film-free, but it's no mystery because this new series of AHCO Burnishing Compounds is formulated only from non-saponaceous materials that contain the last word in surface-active agents. These compounds are free-flowing, dry, non-toxic, and non-corrosive powders which are, of course, freely soluble in water. They're prepared especially for applications where the sticky residues from soap-like mixtures are objectionable. For rolling and burnishing before plating, AHCO burnishing Compounds assure excellent adhesion and maximum lustre. For preparing surfaces before lacquering, painting or other processing . . . for burnishing plated parts to remove plating compound residues, that would cause staining or spotting, there are AHCO Burnishing Compounds made to order. Find out *now* how one or more of the many new AHCO Burnishing Compounds can do that better job in your plating or finishing room.

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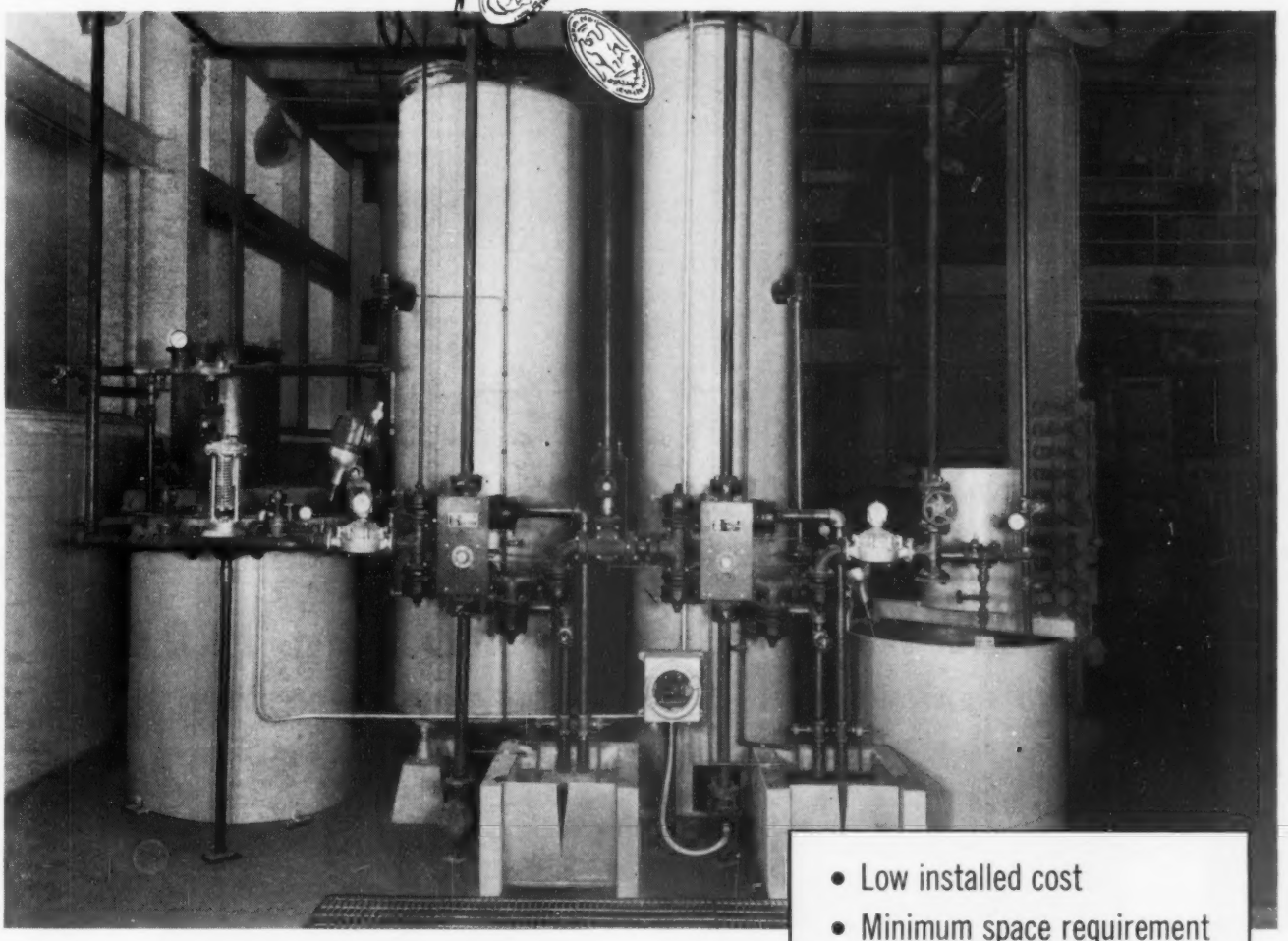
There's Money In Your Plating Wastes!



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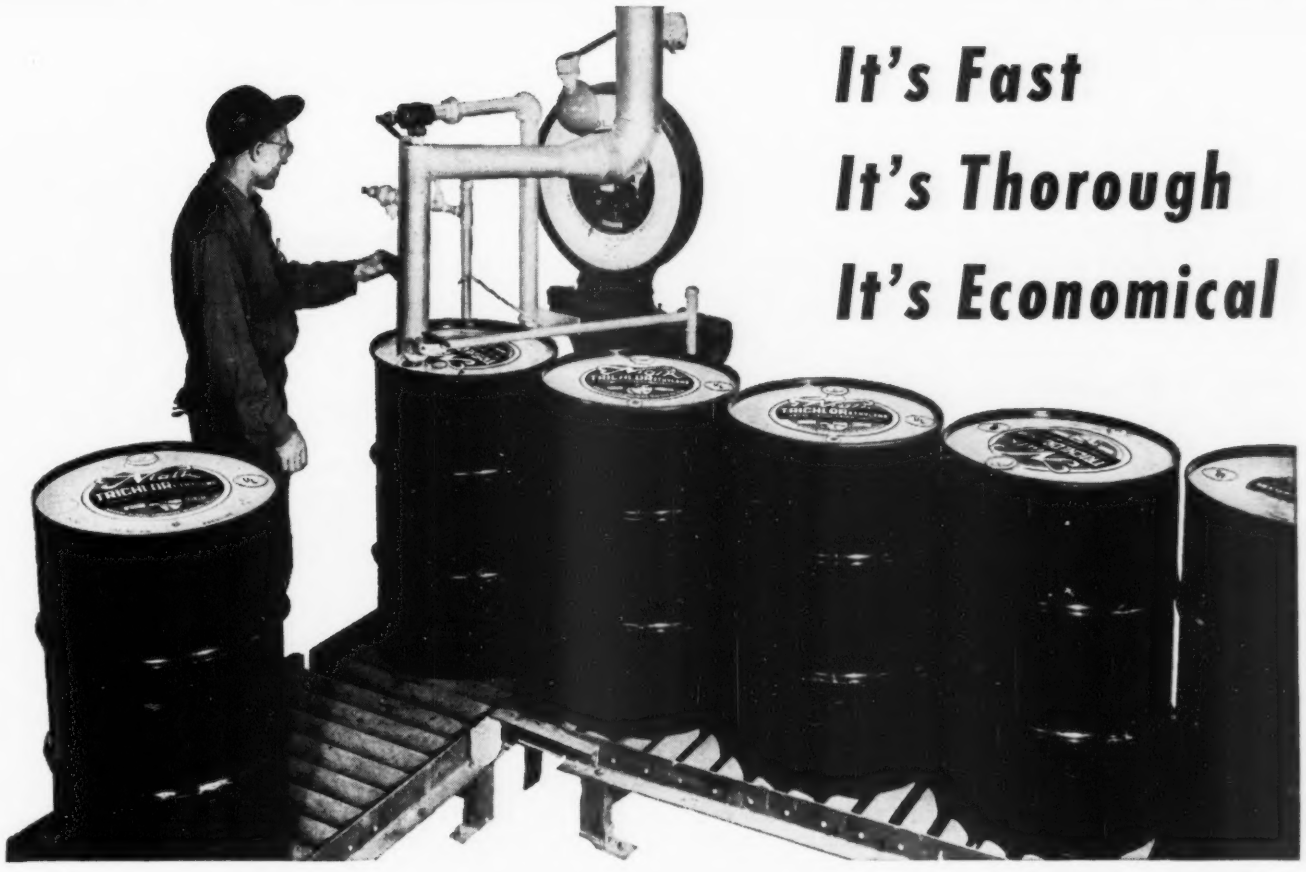

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SILVER SOL-U-SALT | INDUSTRIAL SILVER BRIGHTENER

Regardless of your requirements regarding thickness, precision and high speed operation, the completely modern combination of Sel-Rex SILVER SOL-U-SALT and Sel-Rex INDUSTRIAL SILVER BRIGHTENER will reduce operating costs, cut rejection rates and achieve results that *cannot be obtained with any other process presently on the market.*

Sel-Rex SILVER PLATING Is a ONE-STEP Process

Sel-Rex Silver Sol-U-Salt is a water soluble, crystalline cyanide salt containing 54% metallic silver. Add it directly to the bath — for either solution make-up or maintenance — calculating, mixing, and filtering are eliminated. Sol-U-Salt is completely pure . . . reagent grade quality at technical grade price . . . is simple, clean and less hazardous to use . . . cuts waste from spillage and residual loss.

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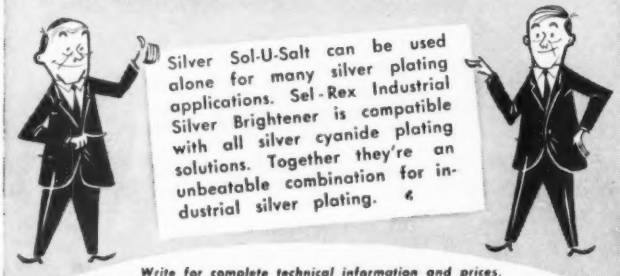
Completely stable for either intermittent or continuous operation, Sel-Rex Industrial Silver Brightener produces smooth, hard and ductile silver deposits regardless of thickness, and is particularly useful in high speed plating operations which require heavy deposits. It gives a semi-bright finish that also has decorative applications. It's economical too, both for make-up and maintenance.


Silver Sol-U-Salt can be used alone for many silver plating applications. Sel-Rex Industrial Silver Brightener is compatible with all silver cyanide plating solutions. Together they're an unbeatable combination for industrial silver plating.

Write for complete technical information and prices.

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Attention, Mr. Plater!

How Many of These Problems Are You Facing?

—Troublesome impurities in plating solutions

—More demanding waste disposal laws

—Rejects traceable to unexpected preparation failures

—Short-lived parts returned from field service

—Inconsistent quality due to differences in surface condition of polished and buffed parts

—Wide variations in salt spray corrosion resistance tests

The Research Program of the American Electroplaters' Society is looking for better answers to these and other problems. Considerable progress is being made right along, with valuable information on results supplied frequently to Sustaining Members in complete Project Reports. As always with basic research, many of the best answers still lie in the future and will find their way into regular plating practice in a quiet and undramatic way. But the contributions to progress of the electroplating industry, and the resultant personal security for everyone connected with it, will be there.

The *rate of progress* depends on the funds available for the Program — primarily from *Sustaining Member* firms.

DOES YOUR COMPANY HAVE AN A.E.S. SUSTAINING MEMBERSHIP?

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Chromium platers get better service all around from the Unichrome original round anode

- In replacing "flats" with *Unichrome Round Anodes,* an automotive plant saved as much as their initial cost – by eliminating former weekly maintenance cost for lifting out flat anodes, brushing them clean and correcting warpage, all at overtime pay. What's more, the anodes plated better with *less power,* enabling a $29,000 standby generator to be switched to other work!
- Merely by switching from flats to *Unichrome Round Anodes,* another plant cut hard chromium plating time by a cost-cutting 20%.
- Through the better current distribution of *Unichrome Round Anodes,* a third user got better coverage on small parts, eliminating all rejects due to "shadowing"!

THE FACTS are in. Working proof of greatly improved lead anode performance is being obtained in more and more users' plants. The new, special alloy cylindrical anode developed originally by United Chromium is contributing in a big way to better chromium plating operations.

Here's why: Cylindrical shape gives better and more efficient distribution of current for better plating. (Watch the entire surface "gas" in the tank – evidence of more active anode area.) This not only prevents corrosion and fouling at the "back" of anodes but also stretches service life. More rigid too, the round shape stops warpage.

This original Unichrome design is no experiment – it is actually paying off on the job. Get in touch with your nearest office of United Chromium for complete details on this money saver.

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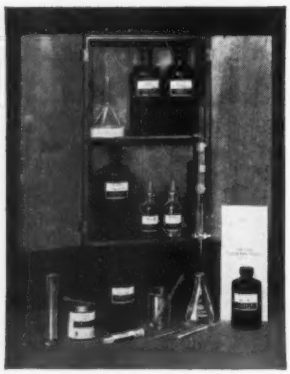
use KOCOUR TEST SETS

to analyze your nickel solution

You can't afford to let your nickel solution go without systematic control. By keeping the nickel solution balanced, material waste and rejects will be minimized . . . conductivity increased . . . power consumption lowered and most important, quality of the work will be uniform. Smooth production and high quality work are no accident. They are the result of constant maintenance. Be sure of tomorrows production today . . . analyze your nickel solution periodically.

KOCOUR ANALYTICAL SET



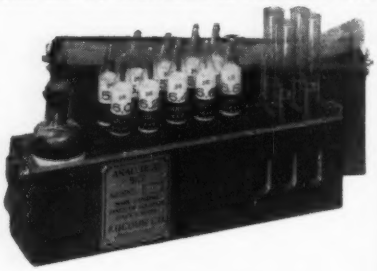
Model N-24 . . .

is used to determine metallic nickel, chlorides, and boric acid content in nickel plating solutions. Readings are directly in oz./gal. . . . results are dependably accurate.

• Other sets are available for the control of black nickel solutions, and other ingredients such as hydrogen peroxide, sodium perborate, epsom salts and sodium sulfate in nickel solutions.

pH Control of Nickel Solutions

pH of the nickel solution can be controlled at the tank with the Kocour pH Comparator Model BCG (range 3.8-5.4) or Model BCP (5.2-6.8). In Bright Nickel solutions, control pH with the economical Kocour Quinhydrone pH Meter Model A.



• KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
Write today for complete information — no cost or obligation.

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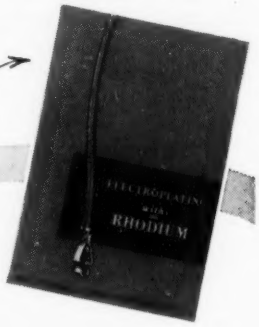
Resists Corrosion

The hard, brilliant white finish of Rhodium plate strongly resists corrosion, making it ideal for electrical and electronic applications. This exceptional property assures protection against atmospheric conditions, providing an excellent finish for ultra-high frequency applications. Its hardness and chemical resistance are unmatched for use with reflectors, particularly with the open arc.

Rhodium plate retains its highly reflective surface indefinitely and does not diminish on exposure to corrosive atmosphere. For decorative, industrial and commercial applications, Rhodium plate qualifies as the top finishing material.

For valuable data on other properties and applications of RHODIUM PLATE, write for free detailed booklet.



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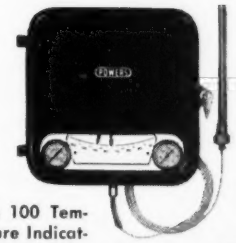
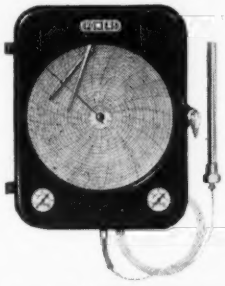


Series 100 Temperature Indicating Controller. Below: Recording Controller.



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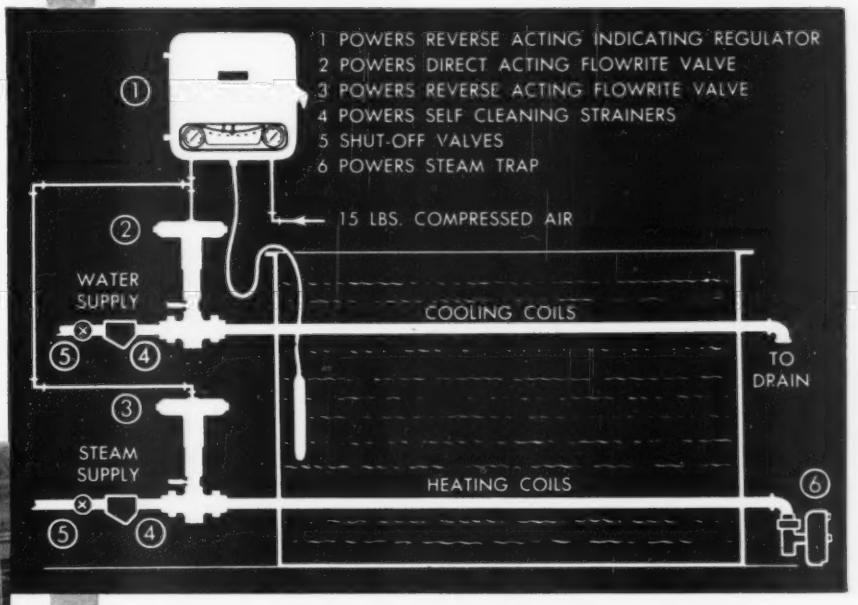
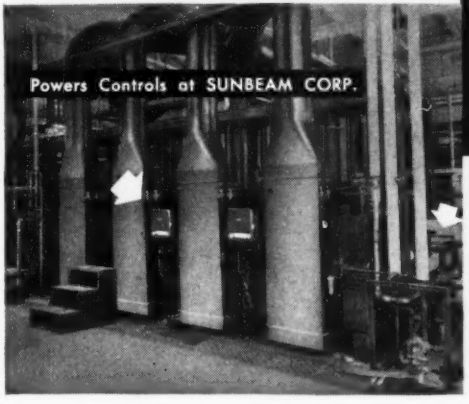
Powers V-Port Characterized **FLOWRITE** Valves are outstanding for their extremely accurate control and continuous trouble free operation.





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Pneumatic TEMPERATURE CONTROL

QUICK RESPONSE to Temperature Changes is obtained with POWERS control when applied to processes where a heating cycle is followed by a cooling cycle or vice versa.

In the example illustrated above chromium or nickel plating solutions are controlled. Either a Powers Series 100 Recording or Indicating Controller may be used. As temperature of the solution in the tank rises to set point of controller it gradually shuts off valve on steam supply. If temperature in tank rises above the set point, the controller quickly opens the valve on the cooling water supply which accurately maintains the solution at a uniform temperature.

Safety Feature: If compressed air supply to the controller should fail, steam valve is automatically closed and water valve is opened preventing any damage which might occur from over-heating.

Accurate temperature control will help your employees turn out more work and improve QUALITY. Preventing overheating saves steam and helps obtain the most effective use from solution under control.

Below: **POWERS No. 11 Self-Operating Temperature Regulators.** Standard type (left) is widely used for water heaters, metal parts washers and many other processes. Ask for Bul. 329. No. 11-MF (right) is simplest, most dependable regulator made for 85% of Metal Finishing Processes. Has durable plastic thermal bulb and tubing highly resistant to various solutions. Easy to read 4" dial thermometer indicates temperature of solution under control. Ask for Bulletin 330.

For **HEAT EXCHANGERS** and metal parts washers Powers **ACCRITEM** air operated Temperature Regulator is used with **FLOWRITE** Valve above. Ask for Bulletin 316.

Check your temperature control requirements with an experienced POWERS engineer. With a complete line of self operating and pneumatic operated controls he can help you select the right type of control for your requirements.

THE POWERS REGULATOR COMPANY

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OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

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The process of ionXchange offers the newest, simplest, and cheapest method of disposing of contaminated and weakened plating solutions. Instead of draining off such "waste" solutions, or treating them chemically where draining is impossible, ionXchange provides (a) recovery of most of the remaining plating acids for use in new make-up, (b) de-ionization of the contaminants so the effluent is clean and non-polluting, and (c) substantial savings in plating costs. *Practical* equipment is now available for treating chrome plating, anodizing, and other solutions.

TREATS RINSE WATER FOR RECOVERY AND RE-USE...

IonXchange also offers a method for treating rinse waters that accomplishes valuable improvements. Instead of running rinse water to drain in large quantities, ionXchange will (a) purify it completely so it can be recycled, (b) recover drag-out plating acids and make them available for new make-up of plating solution, and (c) reduce plating costs to a noticeable degree. Reprints of articles describing these operations, and pictures of successful installations, will be forwarded on request. Our representatives are available to consult on your specific needs.

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March 19
Hotel Faust — Rockford, Ill.

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LOS ANGELES BRANCH
Educational Session and Banquet
March 19
Hotel Ambassador — Los Angeles, Calif.

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TRI-STATE REGIONAL
Annual Dinner Dance
March 26
Columbus, Ohio

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ROCHESTER BRANCH
Technical Session and Banquet
April 16
Hotel Seneca — Rochester, N. Y.

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BOSTON BRANCH
Technical Session and Banquet
April 30
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In Conjunction with
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for Stainless Steel, cast and malleable irons

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Important Features of BLACK MAGIC S.S.

One bath	Good abrasive Resistance
One salt	Attractive Black Finish
Low temperature 255°F	Economical to apply
Excellent Corrosion Resistance	Will not chip, flake or peel.

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THE ONLY SHOW IN 3 YEARS! Don't miss this big opportunity for a mutual exchange of ideas, plus a chance to see and talk to all the people who have contributed engineering advancements, research and know-how to the fast changing industrial finishing industry.

1001 IDEAS FOR BETTER FINISHING!

It is important to KEEP UP TO DATE!

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1955 INDUSTRIAL FINISHING EXPOSITION
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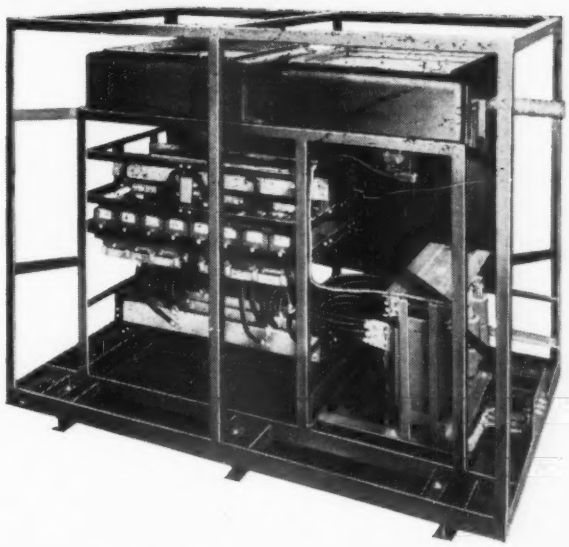

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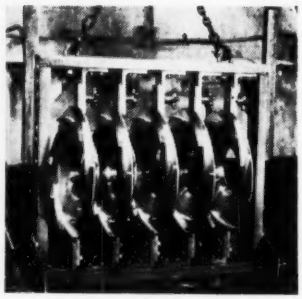

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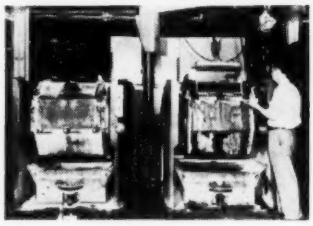

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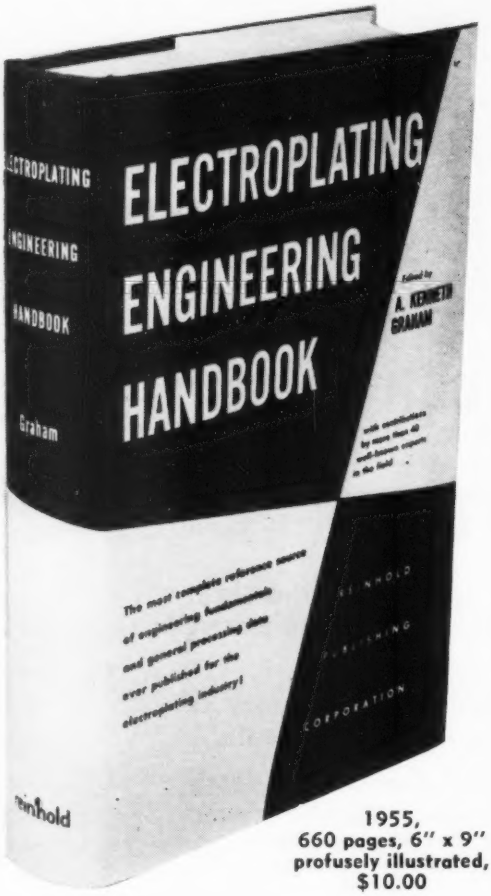

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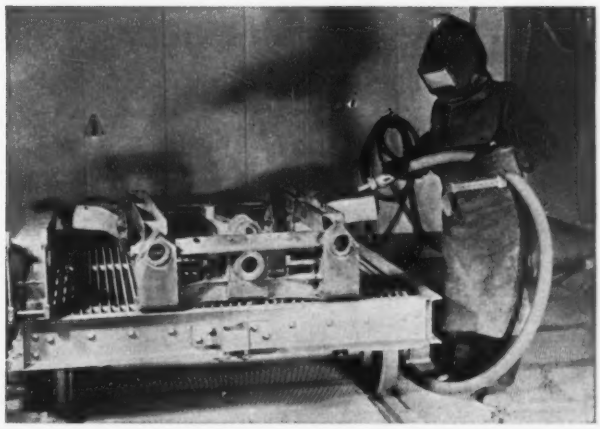

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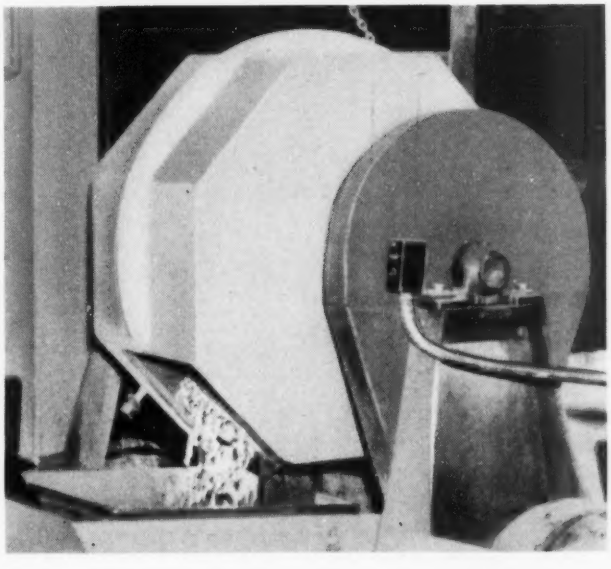

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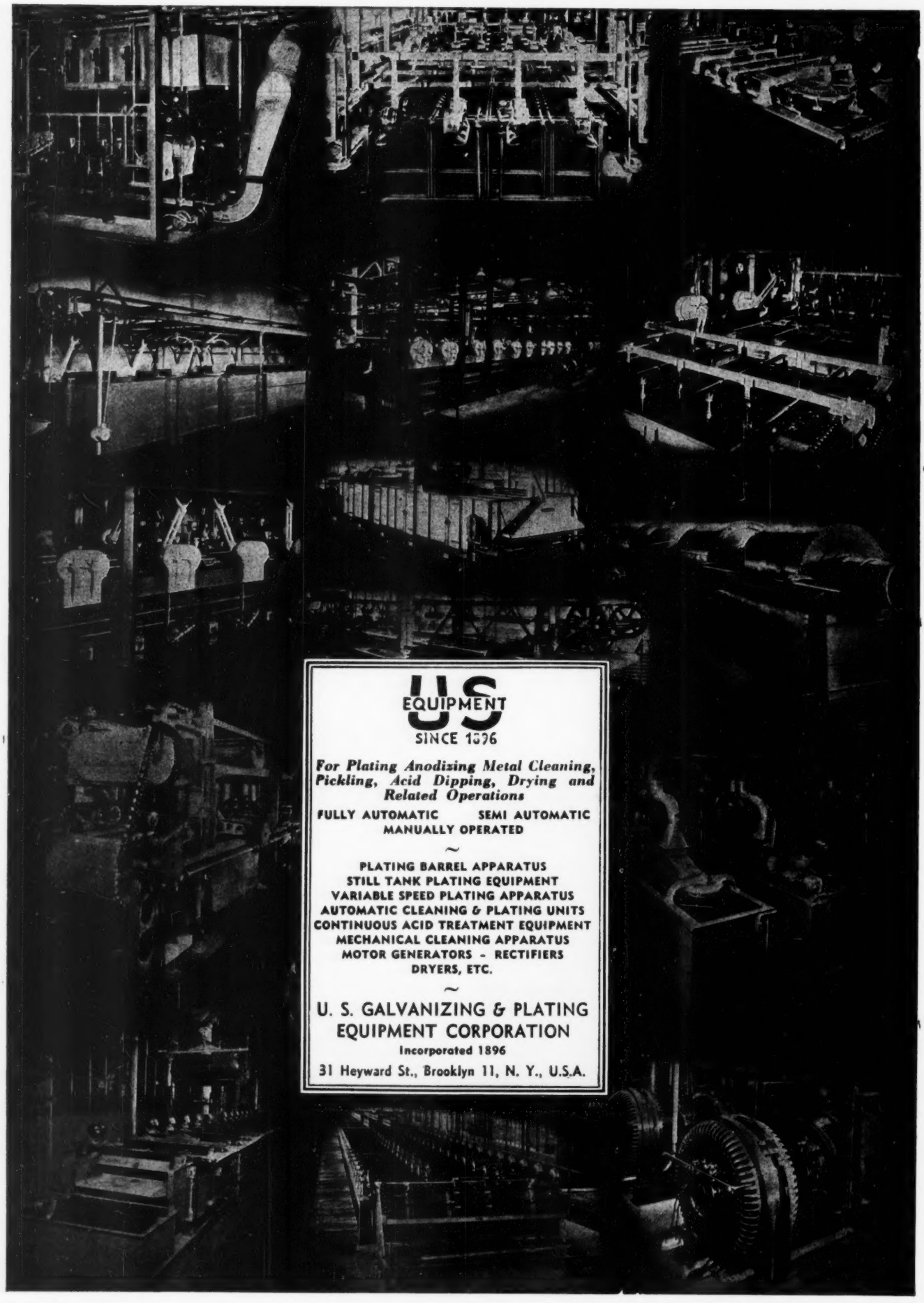
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Principles and Practices of Electroplating

The sustained interest in electroplating courses, as evidenced by their continued popularity and large registrations, emphasizes the need for an educational program geared to the capabilities of those who seek to keep pace with the technical advances in electrodeposition but lack the groundwork which is essential for effective interpretation and evaluation of the information available in current literature.

These courses date back almost half a century and, during this period, have been conducted regularly in many populous areas where metal finishing plants are generally numerous. However, in recent years, manufacturers have found it desirable, for various reasons, to move away from these centers of industry into the less populated hinterlands. This decentralization has put at a disadvantage many platers of limited technical background, who need and desire such courses. It was with these men in mind that we prevailed upon *Louis Serota* to prepare an extended series on principles and practices, the first installment of which appears in this issue.

This series is based on the popular course which the author has conducted for practical platers since 1950 at Brooklyn Evening Technical High School, and which has served as a good opportunity to gain a proper appreciation of their educational needs. Experience has shown that the basic requirements are for the fundamentals of chemistry, electrochemistry and electricity, detailed procedure for arithmetical calculations, and interpretation of graphs. So that the relationships will be driven home most effectively, all the applications of these fundamentals will be considered as electroplating functions.

It is evident that such articles cannot provide the student with some of the advantages of a personally conducted course; the development of laboratory techniques, discussion of problems with other students and field trips, all of which serve to increase confidence in his ability to cope with plating problems. However, within the limitations of the printed page, these articles will acquaint the reader with the scientific foundation on which electroplating stands so that new developments will no longer appear as a bewildering array of facts, terms, and conditions.

Nathaniel Hall

Inhibited Acids in Plating Cycles

By J. W. Carroll, *Research & Development Laboratories, Pennsylvania Salt Manufacturing Company*

THE purpose of this report is to discuss the role of inhibitors in acid baths used in electroplating cycles. This is a timely subject because there are platers who believe the use of inhibitors adversely affects adhesion and plate appearance, and are, therefore, impracticable.[1] The results of our study disprove this contention and indicate that properly selected inhibited acids combined with adequate rinsing will not impair adhesion but will provide important advantages including substantial savings in material and labor costs.

The function of acid cleaners in electroplating cycles is generally well understood.[2] During processing, metal oxides are formed. These must be removed before a plate can be deposited. Acid cleaners are used to remove these oxides.

Certain oxides, including heat treat scale, react more slowly with acids than others. This results in the loss of exposed metal and acid during the additional time required for the flaking off of the less soluble scale. Inhibitors are materials added to acid cleaners to prevent continuing reaction between metal and acid during the additional time required to remove the more resistant scale.

Advantages of Inhibited Acids

Following are some of the advantages to be gained by the use of inhibited acids:

1. *Reduction of labor and material costs.* By preventing over-pickling, inhibitors save substantial quantities of metal and acid. Furthermore, the lower acid consumption will make the acid last longer and there will be a saving in labor required to recharge the pickle tank. However, largest savings come from the reduction of rejects. Such savings are substantial where close tolerance must be maintained, as in machine work, and when parts to be plated have already gone through several finishing operations.

2. *Less hydrogen evolution.* When acid reacts with metal, hydrogen is formed. When scale is dissolved, water is produced. Thus, when we see a bath gassing, we know metal is being dissolved. Most of the hydrogen so produced is evolved into the atmosphere carrying with it particles of acid. This spray endangers the health of workers and is corrosive to nearby equipment. When inhibited acids are used, there is practically no attack on metal, little hydrogen is formed, and this hazard is practically eliminated.

3. *Less hydrogen adsorbed by metal.* Some of the hydrogen evolved during the reaction of metal and acid is adsorbed by the metal and is known to cause embrittlement. For this reason many steels, especially spring steels, could not be pickled unless pickling were followed by an operation to remove adsorbed hydrogen. Since the use of a properly prepared inhibited acid greatly reduces hydrogen production, adsorption and embrittlement also are reduced. Some workers[3] have shown that certain inhibitors, while reducing hydrogen production, actually increase the adsorption of hydrogen, sometimes causing blisters in deposits. Fortunately, this is not a general characteristic of inhibitors, but does indicate the need for a careful selection and proper use of inhibited acids.

4. *Improved appearance of the metal.* During pickling, certain areas of scale are removed more easily than others. If the acid is not properly inhibited, the metal will be attacked and etched unevenly, thus marring the smooth surface of the plated metal.. Smut is produced during etching of metal and, when present in appreciable quantity, dulls the luster of plate. Production of smut is minimized by the use of inhibited acids thus improving the appearance of the metal.

5. *Improved rinsing properties.* Inhibited acids usually contain surface active agents which reduce the surface tension of the solution and allow it to rinse more readily. This not only reduces the amount of acid dragged out of solution but, more important, reduces the amount carried over into following baths. Such rinsing properties are particularly important in preventing contamination of plating baths.

6. *Reduction of operator errors.* If the pickling procedure is not automatic, the work must be handled by the operator. Frequently he will not be able to remove the work from the baths on schedule. If unin-

hibited or poorly inhibited acids are used, acid and metal will be consumed, hydrogen will be adsorbed and work will be damaged. Thus inhibitors "take the worry out of pickling."

7. *Longer allowable pickling time or higher pickling temperatures.* Occasionally a plater encounters scale that is extremely difficult to remove. Using inhibited acids, he may allow the piece to remain in the solution for a longer period or he may raise the temperature of the bath with no danger of overpickling. Or, if he wishes to shorten his descaling time to increase production, he may raise his operating temperature without risk of overpickling in areas where there is no scale. This gives the operator greater flexibility in laying out cycles or processes.

8. *Improved stripping operation.* In any plating shop some rejects are bound to occur. When this happens the plate must be stripped; the work repeated. Inhibited acids are useful in this operation since they strip the plate without attacking the base metal. Zinc, cadmium and chromium are readily stripped by inhibited acids.

While the use of inhibitors has increased greatly in recent years, there is still some prejudice based on past experience with poorly selected materials. Unlike today's organic compounds which usually contain nitrogen or sulfur or both, early inhibitors were largely industrial by-products which contained impurities and were difficult to rinse. Today there are many available materials for use as inhibitors, the only problem being the choice of the proper inhibitor for the job to be done.

There is still much to be learned about the exact mechanism by which inhibitors exert their remarkable effect. While it is agreed that the inhibitor is adsorbed on the metal in a mono-molecular film, it has not been established exactly how this film prevents corrosion. Continuing research no doubt will provide the answer to this question.

Another question one might logically ask is, "Why shouldn't the plater buy an inhibitor and add it to his acid himself?" This is one way of using inhibitors, and is widely practiced in the bulk pickling of steel. In more precise work such as pickling prior to electroplating, however, this practice would be dangerous. There are many advantages to be gained by using inhibited acids. Achievement of these advantages depends first upon the proper preparation of the inhibited acid. A workman adding an inhibitor to a carboy of acid or to a pickle tank might easily add too little, or add it in such a way that it would not dissolve. In this event, the line would be operating with essentially an uninhibited acid, and many rejects would probably result. On the other hand, if an over-zealous workman should add an excessive amount of inhibitor in order to ensure good metal protection, difficulties might arise in the plating operation. Inhibitors cannot be used carelessly or indiscriminately. For this reason, inhibited acids are usually manufactured in large tanks, with each batch being checked for quality. This is the best assurance that the proper amount of inhibitor is present in the acid.

In the manufacture of inhibited acids, other materials besides the inhibitors are sometimes added to the acids. Examples of these are wetting agents, which are used to improve pickling and rinsing. Only small amounts are needed, and too much will cause excessive foaming. Therefore, the best way to take advantage of inhibited acids is to buy them as such, rather than try to manufacture a product in each carboy of acid.

Inhibitor Tests

We have studied the use of inhibited acids in electroplating cycles, both in the laboratory and in the field. We will look at some of our laboratory data first. Our first study was an investigation of the effect of the inhibitor film on plate adhesion. The laboratory procedure involved cleaning steel panels thoroughly, pickling in inhibited acids, rinsing, and plating in a bright nickel bath. The amount of rinsing was varied in order to determine the extent to which any effects of inhibitor films can be prevented by rinsing. Following is the method used for testing adhesion. After the panel had been cleaned, the lower $\frac{3}{4}$ inch was flash plated with bright nickel, and then dipped in sodium dichromate solution to passivate the nickel. The panel was then pickled, rinsed and plated. When the panel was sheared along the edges, the deposit where the nickel flash had been passivated lifted. This tab was slit into five tabs (a total of ten on each panel) which were tested by gripping with pliers, and pulling. In pulling, the panel was held flat on the table and the pull was toward the main body of the panel. The plating was carried out in a Watts nickel bath, containing some proprietary brighteners, pH 2.5 at 130°F., 40 amps. per square foot for two hours (approximately 4 mil deposit).

The results of the tests are recorded in Table I. In

TABLE I

Effect of Inhibitor Film on Adhesion of Deposit

Inhibitor	*Acid*	*Number of Rinses*	*Adhesion*
None	HCl	1	Perfect
		3	Perfect
1	HCl	1	None
		3	Very poor
2	HCl	1	Poor
		3	Perfect
3	HCl	1	None
		3	Excellent
4	HCl	1	None
		3	None
5	HCl	1	Perfect
		3	Perfect
2	H_2SO_4	1	Excellent
		3	Perfect
6	H_2SO_4	1	None
		3	None

RATINGS:
Perfect — All tabs broke cleanly at line.
Excellent — One tab caused a lifting of a small segment of plate.
Good — Two tabs lifting small segments each.
Poor — More than two tabs caused lifting.
Very poor — The entire plate could be lifted.
None — The entire plate lifted on shearing the edges.

TABLE II

Effect of Inhibitors in Bright Nickel Bath

(Panels acid dipped in HCl)

Inhibitor	Inhibitor Concentration	Hull Cell Rating: Fresh Bath	Hull Cell Rating: After Carbon Treatment
1	.25C*	9	2 (0**)
	.05C	5	
	.01C	2	
2	.25C	2	0
	.05C	1	
	.01C	0	
3	.25C	8	0
	.05C	6	
	.01C	0	
4	.25C	0	
	.05C	0	
	.01C	0	
5	.25C	1	0
	.05C	0	
	.01C	0	

*C = Concentration of inhibitor in pickling bath.
** = Double treatment with peroxide and carbon.

RATING SCALE:
0 — Perfect
1 — 1st discernable difference from blank
2 — Very Faint Cloud
3 — Faint Cloud
4 — Heavy Cloud
5 - 10 — Progressively worse

this series, a total of six different inhibitors were evaluated. These inhibitors represent different classes of chemicals which are used as inhibitors. A test was run using no inhibitor for comparison. Table I shows that Inhibitor 5 has no effect on adhesion in HCl, and Inhibitor 2 almost no effect in H_2SO_4, even with minimum rinsing. Inhibitors 2 and 3 in HCl have poor or no adhesion with minimum rinsing, but good adhesion with good rinsing. Inhibitors 1 and 4 in HCl and 6 in H_2SO_4 have no or poor adhesion even with good rinsing. From the data in Table I we can conclude:

1. While certain inhibitors do have harmful effects on electroplate adhesion other inhibitors have no effect on adhesion, even with minimum rinsing.
2. Other inhibitors which show harmful effects with minimum rinsing have no effects with good rinsing.

This test shows that, as far as the effect of the inhibitor film on adhesion is concerned, a properly chosen inhibitor in a properly designed plating cycle will have no effect on plate adhesion.

In another series of tests, the inhibitors were added directly to a bright nickel bath, and Hull Cell plates were run, in order to determine the effect of the inhibitor on the plating bath. The following concentrations of inhibitor in the plating tank were chosen to represent conditions of heavy carryover, medium carryover and light carryover:

Heavy carryover — inhibitor concentration in plating bath one-fourth concentration in pickle bath.

Medium carryover — inhibitor concentration in plating bath five hundredths concentration in pickle tank.

Light carryover — inhibitor concentration in plating bath one hundredth concentration in pickle tank.

The inhibitors were used at manufacturer's recommended concentrations.

The Hull Cell tests were carried out at 130°F. by depositing nickel at three amperes for three minutes. The cathodes were polished yellow brass, electrocleaned and dipped in uninhibited hydrochloric acid. After the proper amount of inhibitor had been added to the plating bath, it was maintained at 150°F. for 24 hours before testing. The plates obtained were compared to a blank obtained with an uncontaminated bath similarly held at 150°F. for 24 hours.

In addition to testing the baths with added inhibitor, the bath with the highest inhibitor concentration was treated with activated carbon and hydrogen peroxide to determine whether this method of purification would remove inhibitor contamination.

The results of this test are given in Table II. They show that inhibitors 4 and 5 have practically no effect, even at the highest concentration tested. Inhibitor 2 has slight effect at higest concentration, and none at the lowest.

Inhibitors 1 and 3 have very pronounced effects at the highest concentration, but 3 has no effects and 1 slight effects at the lowest concentration. The effect of these inhibitors on the plating bath were completely removed by carbon-peroxide treatment, except Inhibitor 1, which required double treatment. From the data in Table II we may conclude:

1. Even when added to the plating bath in substantial quantities, certain inhibitors have no effect on the operation of the bath.
2. Any harmful effects which inhibitors might have can be eliminated or greatly reduced by adequate rinsing facilities between pickling and plating.
3. Any effects which might be due to build-up of inhibitor in the plating bath will be eliminated in the periodic carbon and hydrogen peroxide treatment.

A third laboratory test comprised an evaluation of the effect of the inhibitor film on bright nickel deposits. Buffed steel panels were electrocleaned, pickled in in-

TABLE III

Appearance Tests

Inhibitor	Acid	Appearance
None	HCl	Control-Full Bright
1	HCl	Slight Cloud
2	HCl	Full Bright
3	HCl	Full Bright
4	HCl	Full Bright
5	HCl	Full Bright

TABLE IV

Summary of Laboratory Tests

Inhibitor	Adhesion		Hull Cell		Appearance	General Rating
	One Rinse	Three Rinses	High Conc.	Low Conc.		
1	Poor	Poor	Poor	Fair	Fair	Poor
2	Good	Good	Fair	Good	Good	Good
3	Poor	Good	Poor	Good	Good	Good, if adequately rinsed
4	Poor	Poor	Good	Good	Good	Fair
5	Good	Good	Good	Good	Good	Good
6	Poor	Poor	Poor	Good	.....	Fair

hibited acid, rinsed and then plated (0.5 mil) in bright nickel, 140°F., 40 amperes per square foot, 15 minutes. The panels were compared with similar panels prepared with uninhibited acid. Good rinsing was used in these tests. The results given in Table III show that none of the inhibitors except 1, had any effect on the appearance of the bright nickel.

The laboratory tests of inhibitors in electroplating cycles are summarized in Table IV. The summary shows that Inhibitors 2 and 5 give good results over all the tests and could safely be used prior to electroplating. Inhibitor 3 gives good results if adequate rinsing is used. This inhibitor should not be used where there are not good rinsing facilities but, with good rinsing, should cause no trouble. Inhibitors 4 and 6 give poor adhesion results, and should not be used for this reason, even though Hull Cell test results were good. Inhibitor 1 gives poor to fair results and should not be used.

These laboratory tests show clearly that, with proper selection of the inhibitor, inhibited acid can be safely used in electroplating cycles.

Plating Cycles Employing Inhibited Acids

We have shown that laboratory testing of inhibited acids indicates that they may be used safely in electroplating cycles. The real proof of the value of inhibited acids lies in their use in production. Many plants and shops have used inhibited acids for years successfully and profitably. The following are typical electroplating cycles employing inhibited acids:

1. *Removal of brazing scale from typewriter parts prior to nickel plating:*
   a. Braze
   b. Pickle — Inhibited Muriatic, 90°F.
   c. Warm rinse
   d. Electroclean
   e. Rinse
   f. Pickle — Inhibited Muriatic, 90°F.
   g. Rinse
   h. Copper Flash
   i. Rinse
   j. Nickel Flash
2. *Pickling Steel Wire Prior to Bright Zinc in Fully Automatic Machine:*
   a. Electroclean, 43 sec.
   b. Rinse, 15 sec.
   c. Pickle 1:1 Inhibited Muriatic, 15 sec.
   d. Pickle 1:1 Inhibited Muriatic, 15 sec.
   e. Rinse
   f. Zinc Plate
   g. Rinse
   h. Bright Dip
   i. Rinse
   j. Dry
3. *Removing Heat Treat Scale Prior to Cadmium Plating:*
   a. Inhibited Muriatic Acid
   b. Rinse
   c. Rinse
   d. Electrolytic alkaline cleaner
   e. Rinse
   f. Inhibited Muriatic Acid Dip
   g. Rinse
   h. Cadmium plate
4. *Inhibited sulfuric and muriatic acid to remove scale from wrenches prior to nickel plating:*
   a. Pickle in 30% Inhibited Muriatic Acid plus 10% Inhibited Sulfuric Acid at 140-160°F.
   b. Rinse
   c. Reverse clean
   d. Rinse
   e. Sulfuric Acid Dip
   f. Rinse
   g. Plate

Summary

There are many advantages to be gained by the use of inhibited acids. The electroplating industry, which has been reluctant to use these advantages can do so without danger to the work, provided the inhibitor is properly chosen, and adequate rinsing is employed in the cycle.

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Electroplating for Shelf Life

By J. B. Mohler, *Consultant, New Castle, Pa.*

Introduction

MANUFACTURED products must have sufficient corrosion resistance to have good appearance when they reach the customer. This may mean that parts should be protected for a number of months and in many cases for several years. If the part is a low cost, high volume, popular item then it may only be a matter of several months from the time it leaves an inspection department until it is purchased. However if it is a seasonable item, even though popular, it may have to be stored on the shelf from one year to the next. If the item is a replacement part it may lay on the shelf for years. It may retain its appearance for a long period of time while in stock and in the hands of the distributor and yet the surface may eventually corrode. The loss in sales appeal will result in rejection by the customer. Replacement parts have been returned to the manufacturer by the distributor after ten years on the shelf. The manufacturer should not be asked to guarantee shelf life for ten years and yet, if the parts are not replaced, sales of the particular item will stop.

If an item were manufactured and sold in the dry climate of Arizona there would be little demand for protective value. Unfortunately parts must be shipped to the industrial, humid, and salt climates of all parts of the country. Considerable protection is often required merely to transport the stock. The spring rains can spatter water on a cardboard carton on a railroad siding and cause more damage in one day than several years in a warehouse, although storage in a warehouse is no guarantee of freedom from contact with water. A sudden driving rain, an open window, a leaky roof, or spillage of water overhead can cause damage in very short order. Even if such accidents are covered by insurance the usefulness of the part is lost.

It is not uncommon to have corrosion damage to finished and partly finished parts during the spring of the year. With warm days and high humidity, corrosion is accelerated. With cool nights, water condenses on the cold water lines and direct contact with water is brought about by condensation and dripping. Figure 1 shows the monthly averages for humidity readings taken throughout the year. The individual readings varied from 30 to over 70% relative humidity.

Protection Needed

There is need within a plant for protection during processing as well as protection of the finished part.

Steel parts that are freshly ground are particularly subject to corrosion. Other steel parts will rust if exposed to moisture or high humidity. Even if the steel has a thin electrodeposit on it or a thin film of protective oil it is not safe for protection against extreme conditions. Such extreme conditions can even occur in the winter with improper handling of incoming material. If massive steel parts are delivered on a very cold day the temperature of the steel will be below the dew point temperature for conditions in a warm storage room. If they are brought into the storage room a considerable amount of condensation will take place. It is better to use temporary protected outside storage until a warmer day than to bring cold steel into a warm plant.

Protection of parts in process is usually done on a temporary basis, whereas shelf life protection should give several years of life. Also some parts will be plated for protection during service. Thus a plant has problems for protection against corrosion where the protection is expected to last from several hours to several weeks for protection within the plant, for approximately two years for shelf life and for approximately ten years for service.

Means of Protection

There are many different materials that can be used to protect steel from corrosion. Some of these will give temporary protection and some will give permanent protection. Also, there are coatings that will protect against outdoor exposure and other corrosive environments. A few general protective materials and general conditions are shown in Table 1.

Oil is a material frequently used for temporary and shelf life protection. Petroleum products can be used for protection for very short or very long periods of time. If the petroleum product is volatile, such as kerosene, it will only protect until it evaporates, which is a very short period of time. Light oil of S.A.E. 10 viscosity will keep moisture away from the surface but, under extreme conditions, steel parts have been known to rust in several days after dipping in light oil.

A considerable number of protective oils are available, formulated to government and commercial speci-

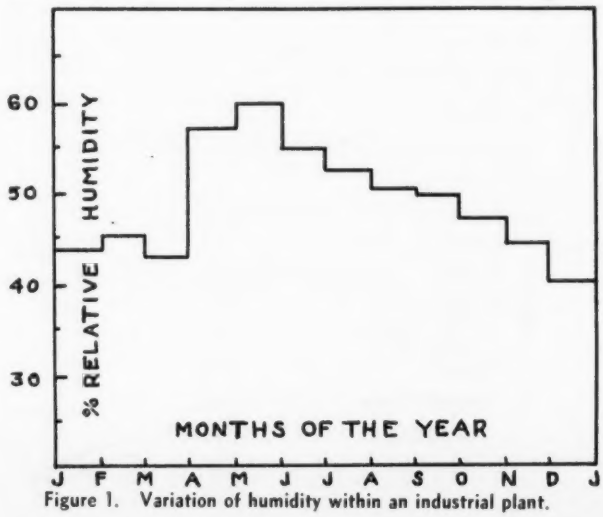


Figure 1. Variation of humidity within an industrial plant.

TABLE 1

Coatings for Protection of Steel

Type of Protection	*Protecting Material*	*Appearance*	*Expected Life*			*Cost*
			Days	*Months*	*Years*	
Temporary	Light Oil	Good	1			Low
Temporary	Protective Oil	Good		6		Low
Temporary	Electroplating	Good		6		Intermediate
Shelf Life	Protective Oil	Fair		6		Low
Shelf Life	Phosphating	Good			1	Low
Shelf Life	Electroplating	Good			2	Intermediate
Shelf Life	Vapor Inhibitor	Good			1	Intermediate
Shelf Life	Packed in Grease	Poor			10	High
Shelf Life	Sealed Coatings	Poor			10	High
Permanent	Electroplating	Good			10	High

fications. Some of these are light oils with substances added to give fair protection and yet sufficiently light to drain to a thin film. Petroleum solvents are sometimes added so that some evaporation will take place so as to leave a thin film. Such thin films are desired in order to retain a good appearance and thus to retain sales appeal. Greases or petroleum jelly may be added so that a light grease is present after the solvent has evaporated. Inhibitors are also added and sometimes metallic soaps are added so that the oil will absorb small amounts of water that may be present, as after a grinding operation. Oils of higher viscosity or oils containing a higher amount of grease will drain to a heavier film and give longer protection. Greases may be applied molten, by dipping, and allowed to solidify, thus obtaining a very thick layer. Also parts may be sealed in plastic, metal, or cardboard containers with grease packing. Thus it is possible to obtain a few hours or many years of protection by the use of petroleum products.

Other means of protecting a metal surface are available, such as strippable plastic coatings, permanent phosphate coatings, vapor inhibitors, lacquers and paints. The selection of a coating will depend on many factors. It will depend on cost, appearance, life, adaptability to production, and whether it adds properties to the part other than protection.

COST:

For temporary protection on the shelf a simple dipping process using light protective oils or phosphate coatings is being used. Wrapping in paper containing vapor inhibitor is also a convenient method at a little higher cost. Such methods are used for finished parts, for temporary protection while in process and for temporary storage of incompleted parts. These protective means are also useful for temporary storage of tools so that the same method can be used to protect the product and the production equipment. Any of the permanent or long life protective processes are more costly.

APPEARANCE:

An attractive finish can be applied to the part by the use of many chemical, electrochemical or organic finishing processes. However the more complicated and costly finishing methods are used only where appearance is of prime importance. And yet a low cost protective means that provides a good appearance will have sales value. Electroplated coatings are often used because of good protection at relatively low cost.

LIFE:

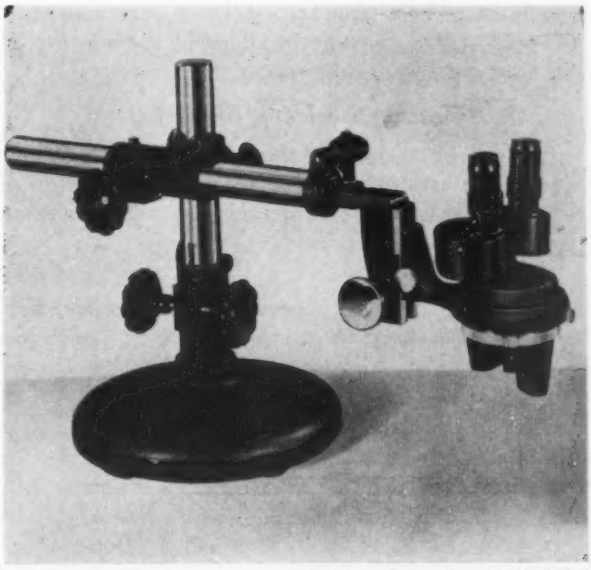
The life of an electrodeposit is a matter of the thickness of the coating and the service to which it is subjected. For light duty, such as metal trim, panels or handles used for indoor service, a relatively thin deposit will give a lifetime of service. For parts that come into contact with the hands frequently, such as door knobs, a heavier coating will also have very long life. Electrodeposited coatings have the advantage that a very thin or a very heavy layer can be applied, so that the optimum plating thickness can be selected to satisfy the factors of cost and appearance.

ADAPTABILITY TO PRODUCTION:

An electroplating process is usually one of the final production steps, so that the electroplating department is often located near the final inspection department.

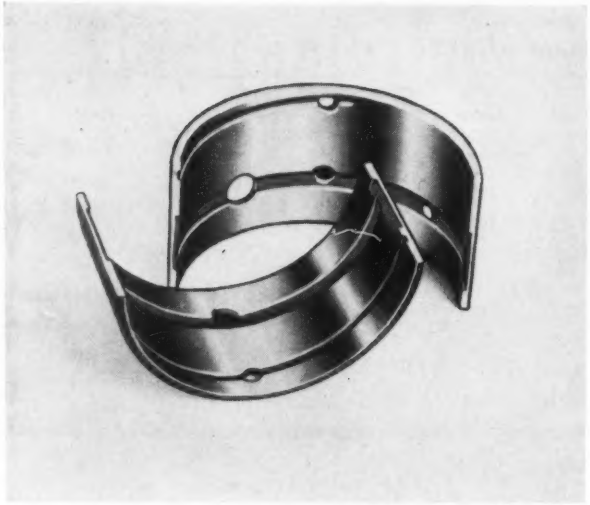
If it is not necessary to protect all surfaces or, if the production steps are not harmful to the surface, the electrodeposit may be applied earlier in the production line so that the part is protected while in process. Also, a clean, plated part may simplify manufacturing by elimination of dirt and scale, and by presenting a low friction surface to forming tools.

Low cost stamped and formed parts are often manu-



(Courtesy of American Optical Co.)

Stereoscopic Microscope.
An example of plating for appearance and long life in laboratory atmospheres. The steel pillar and arm are chromium plated. The knobs are of brass with copper-nickel-chrome plating.



(Courtesy of Johnson Bronze Co.)

Sleeve Bearings.
An example of plating for shelf life of two years. The steel backed babbitt lined bearings are flash tin plated and dipped in a light protective oil.

factured from pre-finished strip. Such pre-finished strip is commercially available in a variety of electroplated and other finishes.

ENGINEERING FACTORS:

Size and surface properties of the coating often are of importance. A very thin deposit with anti-friction properties can be obtained by the use of a proper phosphate treatment or by the use of a thin coating of tin.

Electrodeposited Metals

Many different metals can be applied to a surface by plating methods. Table 2 shows a listing of properties that will be obtained by the use of thin deposits of various metals. In the case of the low melting metals, zinc, cadmium, tin, and lead, these surfaces can also be obtained by hot dipping methods.

If a coating is selected for shelf life alone it would probably be either zinc or tin. On the other hand, for a little more cost, appearance, more permanent life, and wear resistance could be added by the selection of nickel or chromium over copper.

Plating Steel for Shelf Life

It is difficult to estimate the minimum safe thickness required to assure protection for a definite period of time on the shelf. A considerable amount of data on corrosion has been taken and interpreted[1] that can be used as a rough guide. However, the only reliable test is an actual shelf life test. This will take time, but time will eventually pass. Short time accelerated testing, such as a humidity cabinet or a salt spray, will give an indication of the effect of roughness of the steel, shape of the part and thickness of the deposit. But no reliable calculation exists to accurately interpret such data in terms of shelf life. In the long run a shelf life test will save experimental time. Such a test consists of preparing specimens with known coatings on them and storing them under enough different conditions or in enough localities to represent the types of atmosphere to which they are liable to be exposed.

Experience with other materials can be used as a guide. Figure 2 is an estimate of the tin thickness required for several years of shelf life. This is really based on the amount of tin required to produce a deposit that is essentially free of pores. A highly polished steel surface can be effectively covered with .05 mils of tin but a rough surface may require 20 times this amount.

Figure 3 is an estimate of the thickness required for steel with a cold rolled finish. It will require about 0.1 mil of tin to produce a coating with low porosity. Such a thickness would be required for short time protection, but should be good for two years. If the tin is dipped in a protective oil a much thinner deposit can be used. This is shown in the lower curve where a light protective oil is used that is expected to give six months protection when used directly on steel.

For short protection times, zinc is much more effective than tin. This is due to the fact that the steel will not corrode as long as it is covered with zinc, even though the coating is porous. Zinc is the corrosive metal in an iron-zinc couple and as long as there is not too great a break in the coating it will protect the steel by sacrificial corrosion. In time the zinc layer will corrode sufficiently that the steel will be exposed, thus longer protecting times require greater thicknesses of zinc.

Tin will also corrode with time, but the corrosion rate is much slower than for zinc. Consequently, for long time corrosion resistance where the deposit is heavy enough to be free of pores, a thinner tin coating can be used than a zinc coating.

ZINC PLATING:

Zinc can be deposited from an acid bath or a cyanide

TABLE 2

Corrosion Resistance by Use of Electrodeposited Metals

Metal	*Tarnish Resistance*	*Corrosion Resistance*	*Appearance*	*Pinhole Corrosion*	*Cost*	*Shelf Life Thickness Mils.*
Zinc	Fair	Fair	Good	No	Low	0.2
Cadmium	Fair	Fair	Good	No	Low	0.2
Tin	Good	Good	Good	Yes	Low	0.1
Nickel	Good	Good	Good	Yes	Int.	0.1
Chromium	Excellent	Excellent	Excellent	Yes	High	----
Copper	Poor	Good	Poor	Yes	Low	0.1
Lead	Poor	Good	Poor	Yes	Low	0.1

TABLE 3

Comparison of Acid and Cyanide Zinc Baths

	Acid Bath	*Cyanide Bath*
Throwing Power	Poor	Good
Appearance	White	Bright
Plating Rate	Good	Limited
Cost	Low	Higher than acid
Tanks	Lined	Can use steel
Control	Simple	Complex
Efficiency	High	Limited
Preparation	Metal must be clean	Bath has some cleaning power

bath. The cyanide baths are popular because bright deposits can be obtained that have good throwing power. Many proprietary baths are available that are not difficult to operate, although they must be carefully controlled to obtain consistent results.

For thin deposits and where the best appearance is not required, a plain zinc cyanide bath can be used without resorting to the addition agents and addition agent control of the proprietary baths. Also, for thin deposits, it is not necessary to pickle the steel prior to plating.

The acid zinc bath is simple to operate and good white deposits can be obtained. Better cleaning is required than for the cyanide baths and the throwing power is poor. With poor throwing power it will be necessary to plate more metal in order to get sufficient thickness in the recessed areas.

If thicknesses of more than 0.1 mil are to be deposited, it is necessary to clean and pickle prior to plating. The pickling step will assure a bonded deposit and such bonding is necessary in order to avoid blistering and peeling with heavier deposits.

TIN PLATING:

Tin can be deposited from an acid or an alkaline bath. The general characteristics are similar to the two

TABLE 4

Comparison of Acid and Alkaline Tin Baths

	Acid Bath	*Alkaline Bath*
Throwing Power	Low	High
Appearance	Good	Good
Plating Rate	Limited	Limited
Cost	Higher than zinc	Higher than acid tin
Tanks	Lined	Can use steel
Control	Complex	Simple
Anode Control	Simple	Difficult
Efficiency	High	Limited
Preparation	Metal must be clean	Bath has good cleaning power

zinc baths and the alkaline bath is more widely used because of good cleaning power and good throwing power.

Consistent results can be obtained from an acid tin bath at 100% anode and cathode efficiencies. The bath must be operated with the use of addition agents, which means that more careful control is required than in the case of the acid zinc bath. Fair plating rates can be obtained, but it is difficult to operate at high current density due to limited plating range.

The alkaline tin bath has essentially an unlimited plating range. Good deposits can be obtained at all current densities although the cathode efficiency drops sharply as the current density is increased. This drop in cathode efficiency with increasing current density accounts for the excellent throwing power of the alkaline tin bath.

For the most economic operation of an alkaline tin bath tin anodes are used. Tin is cheaper as a metal anode than as sodium or potassium stannate. The anode problem adds a difficulty to the operation in that the

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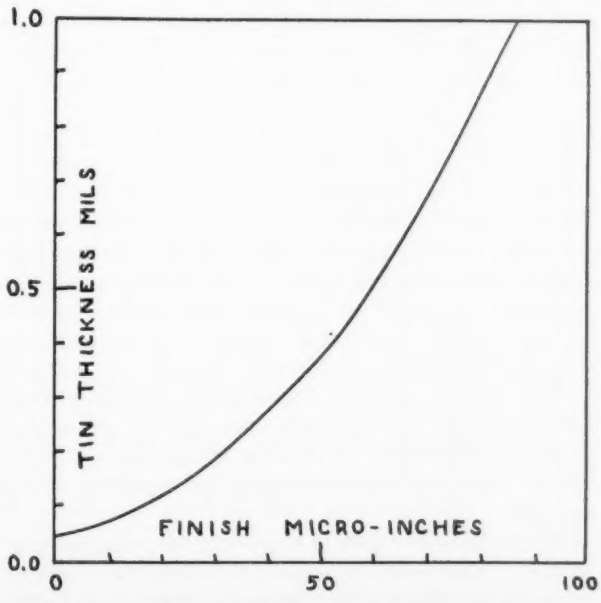

Figure 2. Tin thickness required for shelf protection of various surface finishes.

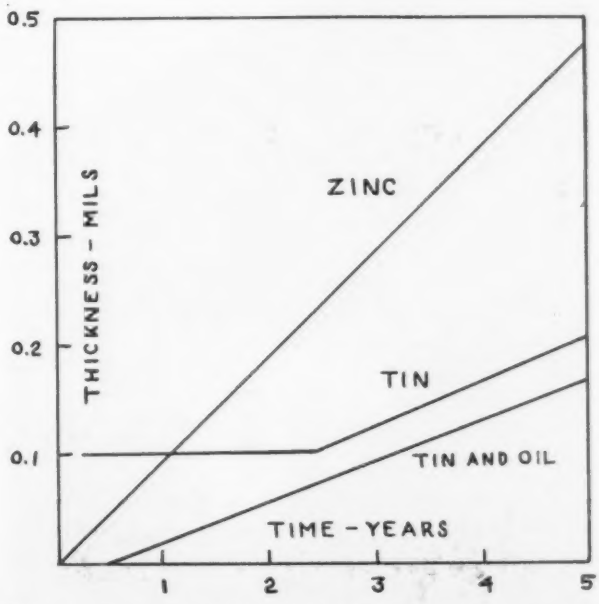

Figure 3. Years of protection for various coating thicknesses and a good surface finish.

Continuous Pickling Stainless Steel

Sheffield Plant of Firth-Vickers

By Dr. Francis F. Jaray, *Consulting Engineer, Worcester, England*

The author, who is a prominent British consulting engineer, specializes in the development of plastics and their use in the chemical engineering field. He was mainly responsible for the design and erection of the pickling plant which is the only one of its kind in the world and which he describes in this article.

IN 1948 and 1949 Firth-Vickers Ltd., the greatest stainless steel manufacturers in Great Britain, decided on the erection of a rolling mill. They were later joined in this venture by Samuel Fox Ltd. of Sheffield and, out of their cooperation, grew the now famous mill which was the first designed anywhere in the world solely for the manufacturing of stainless steel sheet. Following the tradition of the company, and also in accord with the reputation of their material, it was decided only to put in the very best and most modern equipment that ingenuity could devise. A very considerable amount of work and thought has gone into every detail and every precaution was taken to insure a smooth working of the mill.

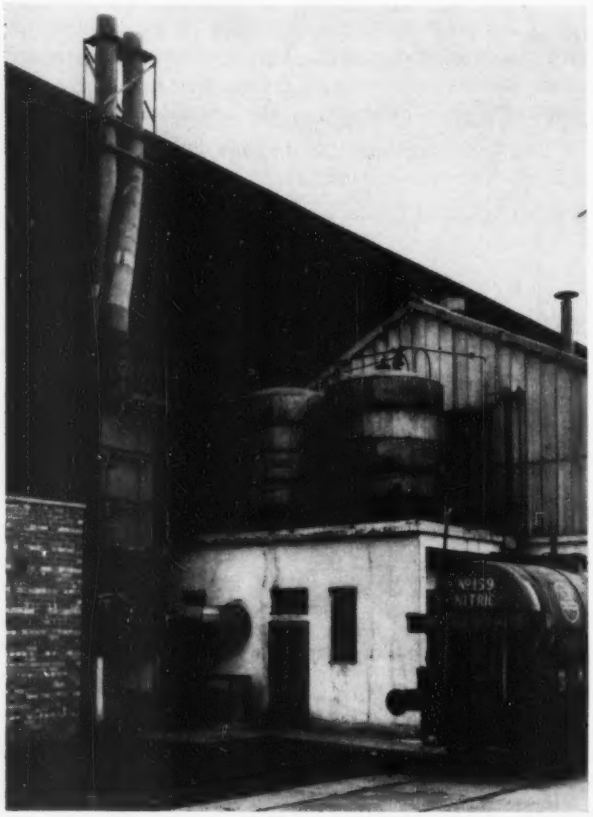

Figure 1

Two pickling lines were installed in the beginning, though it was considered that, in due course, a greater cleaning capacity would be required and all plans were laid out accordingly. A third line is now in the course of construction. The first line which is called in the plant, the "hot line," receives its material from the hot mill. It consists of the usual uncoiler, roller leveller and welding equipment, looping tower, and annealing furnace. It handles strip between 0.180″ and 0.080″ thick at speeds ranging from 3′ to 10′ a minute which makes for an hourly production of approximately 3 tons. In consideration of the material handled, it was

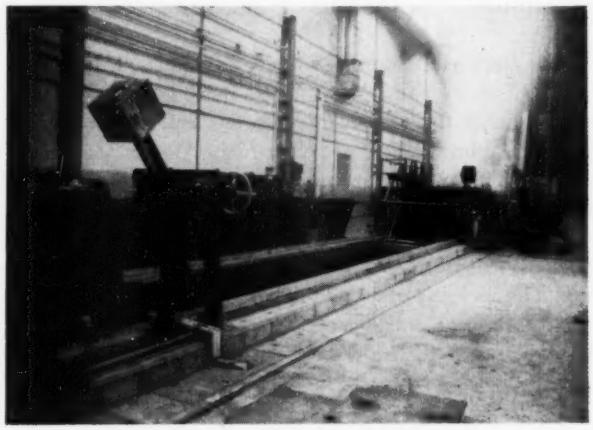

Figure 2

decided to clean the strip in a manner which would reduce metal losses to a minimum. Therefore, the strip emanating from the annealing furnace enters a sodium hydride descaling bath followed by a hot water rinse tank, the alkaline water of which is, at least partially, used again. The neutralized strip then enters the 40 ft. long pickling tank, containing a mixture of 3% HF and 10% HNO_3, after which it is subjected to mechanical scrubbing and drying, then passes through another looping tower to shears and coilers. The strip which has been pickled on this line is then cold reduced further in thickness in either a four high reversing or Sendzimir mill. The strip, which has now a thickness between 0.080″ and 0.010″, passes now through the so-called "cold" line which again consists of uncoiler, welder, looping tower and furnaces but does not contain a sodium hydride bath. Instead, there are two pickling tanks followed by a scrubber and again by dryer, inspection table, looping tower, shears and upcoiler.

All the ancillary gear is housed in the so-called neutralizing plant which is erected alongside the cold line in the open. (Fig. 1) It houses the effluent catchment pit, neutralizing and outfall tank, acid storage and

metering plant as well as the fume handling and scrubbing installation.

Tank Construction

The tanks have all the same dimensions; 40′ long by 48″ wide which allows for a sheared strip width of 1 meter. In order to give the plant the greatest possible flexibility in use, the tanks had to be designed so that they could handle every acid including or mainly nitric and hydrofluoric at temperatures up to 65-70°C. All tanks were further designed so that, if necessary, the chemical pickling could be assisted by electrolytic pickling which in fact is being employed at the first tank in the cold line. The tanks consist of an underground concrete shell, heavily reinforced with integral openings for the fume extraction. They can be clearly seen in Fig. 2, which shows the tank of the hot line. The hoods are removed and stand in the background. They were lined with a non-filled, cut-back bitumen and protected with a 4½″ thick layer of carbon brick which was jointed with a plasticized sulphur cement with carbon filler. When this stage had been reached the tanks were filled with water, heated by injected steam and tested. It was then found that the tanks

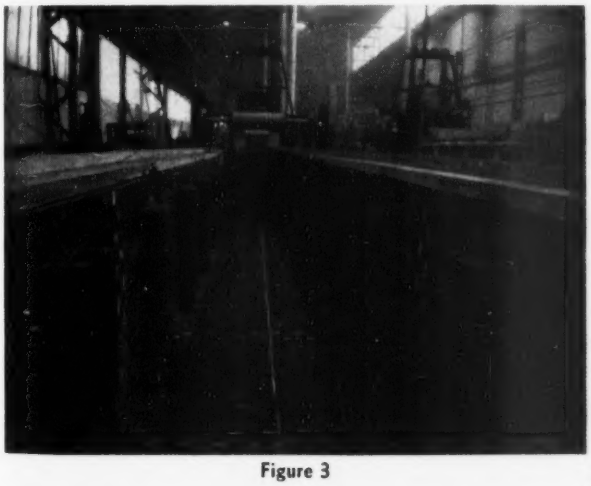

Figure 3

showed an elongation of approximately 0.016″, an amount for which allowance had been made in the surroundings. However, as in an adjoining pilot plant it had been found that electrolytic pickling meant a tremendously quick disintegration of the carbon brick, a second skin of bricks was inserted. This was separated from the outer carbon brick shell by a prefabricated insert of ⅛″ thick low plasticized P.V.C. (polyvinyl chloride). This insert was delivered to the site in six sections and welded together, fitting as snugly as possible to the outer carbon brick shell. The bricks, which were then put into position, consisted of a sulphur cement blend with carbon filler and highly plasticized with Thiokol. The electrical conductivity of these bricks was negligible and, in fact, two years continuous use have not caused any electrolytic corrosion whatsoever. The cement was cast to normal brick sizes and provisions were made to be able to dispense with the sulphur cement chips which are usually employed for such jobs. However, it was found that, in spite of the high plastification with Thiokol, the thermal expansion of these bricks was very considerable and amounted to approximately 0.035″ per foot when raising the

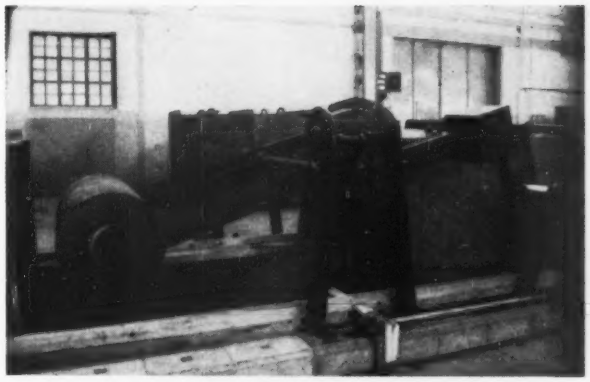

Figure 4

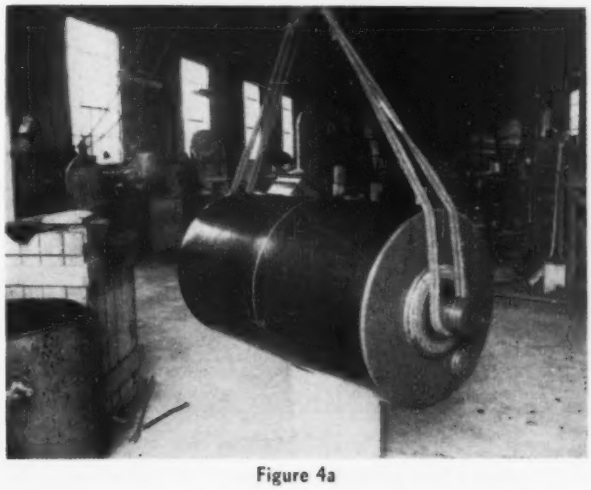

Figure 4a

temperature to 75°C. Inter-locking expansion joints in the single brick shell, which until then had been considered impossible, were made at 5′ intervals, breaking the brick lining into eight independent panels. The joints were filled with sponge and plain soft P.V.C. and have given every satisfaction (Fig. 3).

The greatest technical problem for these tanks was the supply of ducking rollers. They had to be of a sufficiently soft and abrasion-resistant material, inert to the mixture of nitric and hydrofluoric acid at 70°C. and, of course, electrically insulating. A very considerable number of materials were tested and rigid P.V.C. was in the end found to be the only satisfactory material. The ducking rollers which were developed for this purpose consisted of steel shells which were solidly covered with a welded ½″ thick P.V.C. sleeve. The stub-axles were encased in sleeves which had been built up by friction welding and, at the side, provision was made for a positive way of turning the inner shell with the outer casing. The finished rollers were skimmed on a lathe so as to contain a surface running true with the casings of the axle (Figs. 4 and 4a). The ducking rollers are supported on mild steel arms and mild steel gear which, as far as it is exposed to the acid atmosphere is very heavily covered with a vinyl coating. This so far has protected the metal perfectly without any further maintenance other than repair of mechanical accidental damage. Also, the carbon bearings, which are self-lubricating, have stood up very well though mostly running at about the acid level. The tanks are covered with fabricated mild steel hoods lined with P.V.C. which, after two years, does not yet show any sign of wear or tear.

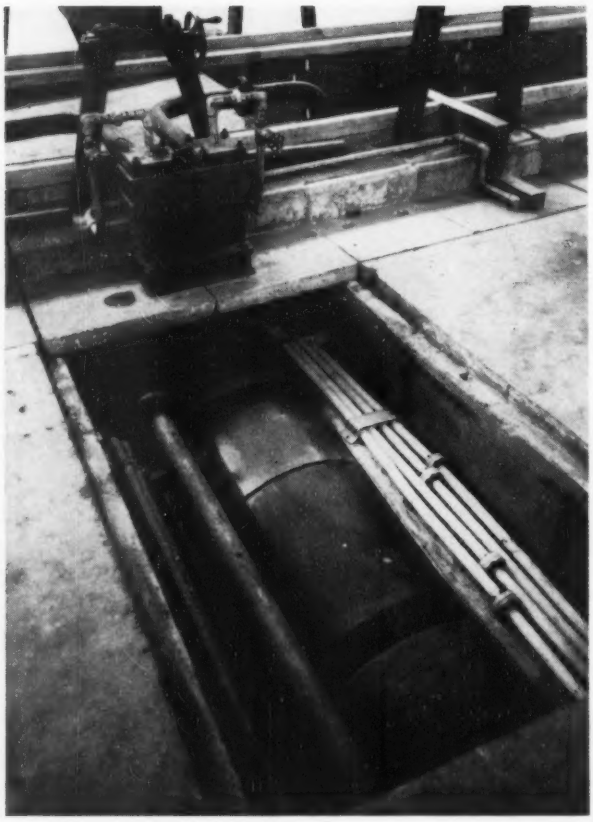

Figure 5

Electrolytic pickling is at present installed only at Tank One of the cold line. While the acid composition for Tank Two and the tank in the hot line, is 12% nitric and 3% hydrofluoric acid, in this tank the contents are 15% nitric acid. The anode which consists of 18/8 titanium-stabilized steel handles 4,000 amperes with a pressure of 18 volt. The cathodes are of similar design and arranged near the ducking rollers.

For starting up from cold, steam is injected until the working temperature of 65-70°C. is reached. The heat generated by the chemical reaction is just sufficient to maintain the proper working temperature. In the electrolytic pickling tank the heat generated electrically is such that the small amount of water which is added by spraying the outgoing strip is not sufficient as it is in the other tanks to keep the temperature at a constant level and more water has to be added.

Each tank is supplied with a water operated carbon ejector with a rigid P.V.C. suction pipe (Fig. 5). The ejectors discharge into the rigid P.V.C. fume extraction duct and, therefore, steam ejectors were not admissible as they would have brought the temperature of the effluent above the safe limit for rigid P.V.C. Incidentally, it was found that water operation was cheaper than steam or, of course, air which is always an expensive commodity.

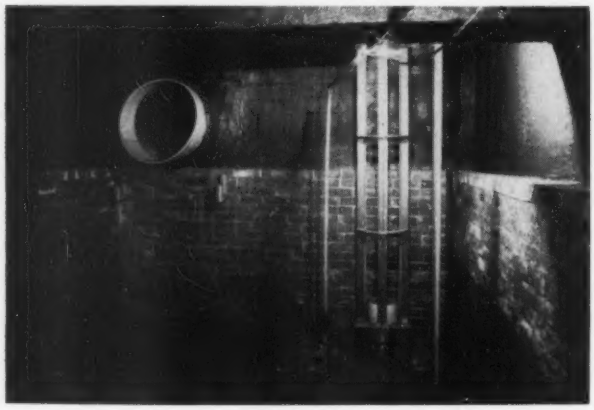

Figure 6

Acid Storage and Neutralizing

The concrete building which was erected for this purpose consists of three sections. The first section has a very large underground collecting tank of a size sufficient to take the contents of all three pickling tanks should they, for any reason, have to be dumped at once

Figure 7

Figure 8

(Fig. 6). The tank, as the rest of the building, is of reinforced concrete construction with a heavy bitumen coating over walls and ceiling; the coating is reinforced on the walls and floor to act as a membrane for covering with 4½" carbon bricks set in plasticized sulphur cement. On ground level, above the acid catch pit and inside the building, is the control chamber with pumps and metering gear, electric switches, fuses, and the like. On the roof formed by its ceiling, are arranged the two 2,500 gallon stainless steel nitric acid storage tanks (Fig. 12). Two acid pumps will, on reaching a certain level of waste acid, automatically operate and pump the acid into the neutralizing tank which is arranged in the second section of the building at ground level. This is totally enclosed and accessible only through a manhole which is flush with the deck on which the acid storage tanks are arranged but is inside

the building. On its ceiling is also arranged a mild steel mixing tank for lime, the outlet of which empties straight into the neutralizing tank through the manhole. Milk of lime and waste acid are intimately mixed with two air-operated injecting circulators (a similar circulator can be seen in Fig. 6 for the waste acid tank) until the recording and indicating pH controller shows that neutrality has been achieved. The contents of the neutralizing tank are then drained into a holding tank in the third section of the building, the ceiling of which forms the storage for burnt lime and is arranged at such height that trucks can deliver at deck level. Hydrofluoric acid carboys are delivered at the same place and both lime and acid are taken by hoist to the upper level in the second section of the building. While the

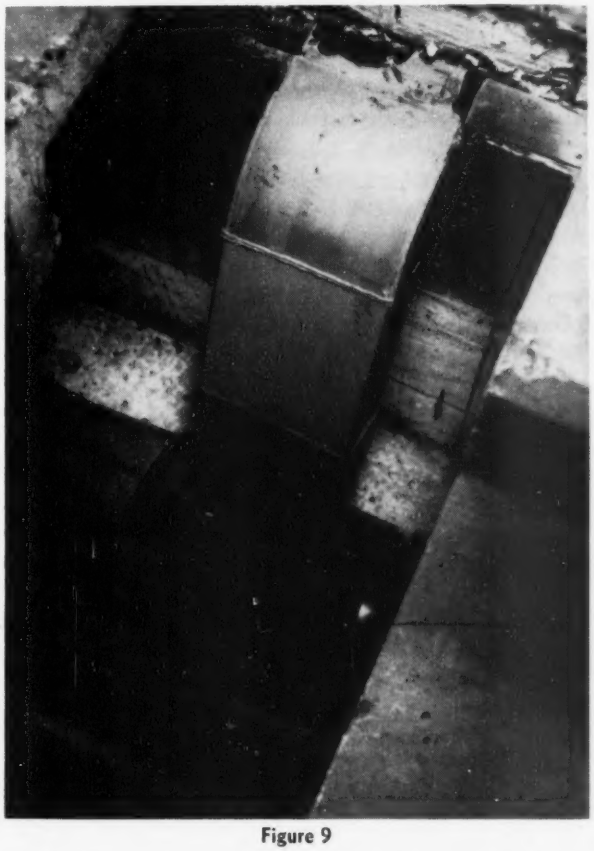

Figure 9

acid carboys can be dumped direct into a hydrofluoric acid holding-tank, the bags with lime are taken two feet higher and dumped direct into the lime mixing tank. The floor between the hoist and the carboy emptying tank which, of course, was subject both to spilled acid and the dragging of the heavy lead carboys, was covered with a $\frac{3}{8}$" thick welded carpet of soft P.V.C. which has stood up extremely well. The carboy emptying tank was made of mild steel, lined with P.V.C. and carbon bricks (Fig. 7). A suspended brick lined tray with inserted polyethylene filter enables easy emptying of the carboys and the retaining of all pieces of straw etc., which may be dumped when the carboys are tipped.

The liquid in the final holding tank is checked once more for pH value as the City Engineers are extremely anxious that no chemically active fluids should go down the drain and also that the rate of discharge should be steady and at pre-determined times. This can be arranged by proper control of the discharge of the outlet tank to the city sewers. Incidentally, a very close watch is kept by the City Engineer on both quantity and quality of outfall and controlling and registering instruments are arranged at the entry to the town sewer.

Both nitric and hydrofluoric acids are taken in polyethylene pipes straight from the storage tanks to the pickling tanks. It had been found that the rather elaborate and complicated acid measuring equipment was unnecessary and that, once the operators had gained the required skill and experience, they could regulate the quantity of acid without having recourse to the equipment that was intended to allow the addition of acid to very fine limits. The valves for the nitric acid line were made from stainless steel and for the hydrofluoric acid line, in P.V.C.

Whereas lime and hydrofluoric acid are delivered by truck nitric acid arrives by railroad tank and is pumped straight from these into the storage tanks. A pump for this purpose is arranged alongside the storage tanks on top of the building (Fig. 1).

Fume Extraction

The fume extraction installation was arranged and designed in such a way that no fumes of any tank should be able to escape into the shop even if, simultaneously, one hood on each tank should be entirely removed. This was achieved by arranging ports in the long walls of each tank of such cross section to insure, if necessary, the exhaustion of a complete blanket of fresh air. Downpipes of rigid P.V.C. were fixed into these ports and then connected with manifolds arranged in trenches alongside each tank (Fig. 8). As men-

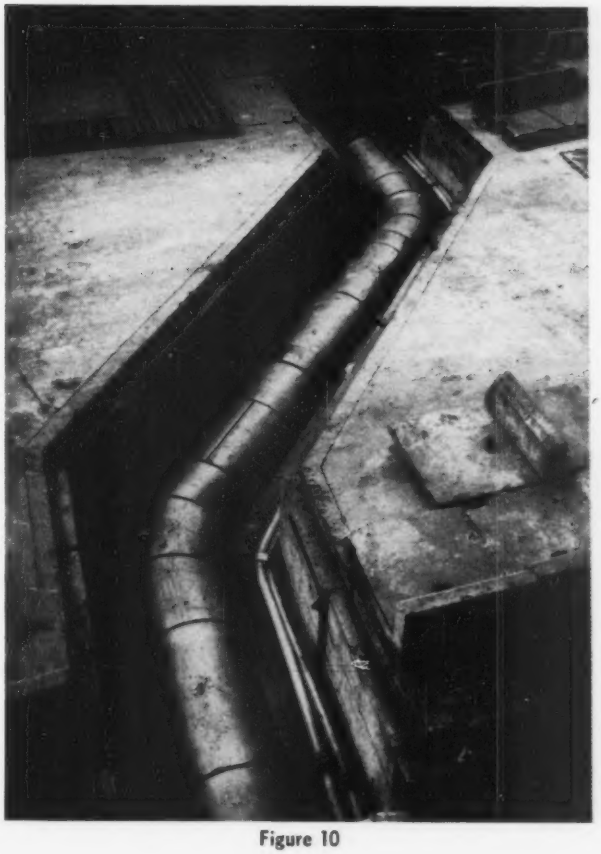

Figure 10

tioned before, the thermal expansion of the concrete shell was practically negligible. It was estimated however, that the thermal expansion of each of the fume ducts might reach anything up to 1½" and it was decided, therefore, to make the connection between the two parts of the ducting system with soft material, even allowing for the danger that the constant contact of the soft material with the strong acid fumes might lead to a destruction of the sleeves within a few years, and the ensuing necessity of their being replaced (Fig. 9). All these side ducts are connected with each other (Fig. 10) and have a diameter of 34" at the end. Rigid ⅜" P.V.C. was used for this purpose. This final manifold duct ends in the waste acid catch pit (Fig. 6) where acid liquid and fumes are separated.

The fumes are taken through a 34" diameter P.V.C. pipe which goes through the control room, (Fig. 11) through the walls and into the bottom of a scrubbing tower. This consists of four sections erected from mild steel and lined with soft P.V.C. The flanges of the sections support, internally, a frame with rigid P.V.C. slats on which again rigid P.V.C. Raschig rings of 3" diameter have been dumped. They are wetted with sprays, also made of rigid P.V.C., which are fed with the alkaline rinse water from the sodium hydride bath. The three wet trays are followed by a dry one in which the majority of the spray is eliminated. Twin stacks (Fig. 1) with inserted polyethylene protected axial flow fans exhaust the purified fumes above ridge level. The small quantity of moisture which condenses in the stacks and trickles down is caught, separated and returned to the acid catch pit.

Another line for pickling will shortly be installed to accommodate the increasing output of the plant. No

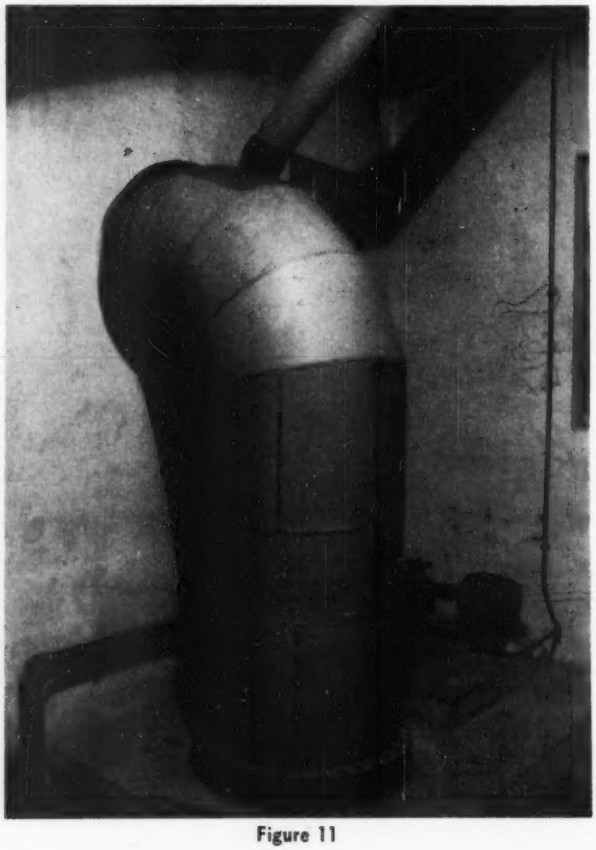

Figure 11

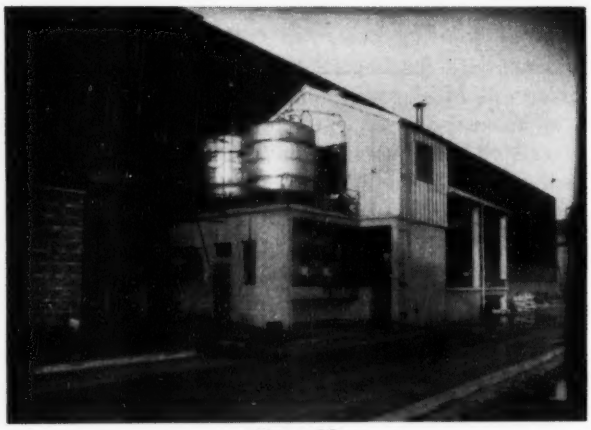

Figure 12

major alteration will be incorporated as this installation, which was so carefully designed and to the success of which so many people have contributed, has shown itself entirely reliable and satisfactory.

Photographs No. 2, 3, 4, 5, 6, 11, 12 are the author's. All others have been supplied by Messrs. Firth-Vickers and the author would like to make use of this opportunity to thank them, not only for the loan of these photographs, but also for their unfailing assistance, advice and encouragement during the planning and construction of the plant which could never have been built and put into operation without their continuous and continued good will.

ELECTROPLATING FOR SHELF LIFE

(*Concluded from page* 67)

anodes must be maintained in a polarized condition during electrolysis. Either a high or a low anode current density will result in loss of bath control.

For plating on small and moderate scales, steel anodes have been successfully used. When steel anodes are used there is practically no trouble with bath control. About all that is required is to add enough sodium or potassium stannate periodically to maintain the plating rate.

Steel backed bearings have been plated by use of the alkaline tin bath to obtain a tested shelf life of more than two years. In this case it is desired to use a thin deposit. Tin is plated to a thickness of .03-.06 mils and, after plating, the bearings are dipped in a light protective oil.

Conclusions

If a low cost, thin, protective deposit is desired, zinc should be investigated as the first possibility. For a very thin deposit, tin with a light oil dip should be considered. For a heavier deposit and relatively long shelf life tin is a more likely prospect than zinc. If appearance is quite important, bright nickel or chromium deposited over nickel or over copper are good possibilities. For unusual corrosive environments, such as contact with acid or acid fumes, copper or lead may be considered. For marine applications cadmium is preferred to zinc.

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Surface Treatment and Finishing of Light Metals

Part V. — Chemical Conversion Coatings (III.)

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M. and R. Pinner, B.Sc.

Chemical Oxidation of Tubes

ANOTHER interesting application of chemical oxidation is the treatment of tubes.[47, 48] Short tubes of 3 in. diameter or over may be treated in the normal way. Longer or thicker tubes can be treated only by a special technique, not because of poor throwing power of the solution, but because the hydrogen evolved during the process may be trapped and form hydrogen pockets, preventing film formation. The interior of the tubes is, therefore, treated under pressure[48] with special equipment designed for the purpose. After treatment by this method for 15 to 20 min., the inside of the tubes is dried at 150°C. for 30 min. and lacquered uniformly on the outside. The lacquering of the inside of straight tubes presents no difficulty. After lacquering, the tubes are dried for 10 to 15 min.

Chromate Process

As described previously in this series, the pretreatments of aluminum surfaces prior to organic finishing often include immersion in a chromic-acid solution, or a mixed chromic-sulphuric acid etch. This treatment produces a very thin aluminum-oxide coating which is impregnated with chromic oxide and which improves the corrosion resistance and adhesion of paint coatings even where a mild degree of abrasion is encountered.

If a chromic-acid solution is employed, this generally contains 5 to 10% chromic acid and is operated at between 140 to 150°F. for about 5 min. A process has recently been developed,[49] however, in which proteins are added to the chromic-acid solution, with the production of corrosion-resistant coatings of the hardness of enamel. This process is applicable not only to aluminum, but also to steel, zinc and brass, and employs a solution containing:—

(a) A corrosion inhibitor, which may be introduced as either chromic acid or a chromate or dichromate;

(b) A hardening agent, which may be formaldehyde, or a heavy-metal salt, though chromate may fill the dual role of inhibitor and hardening agent, provided that it does not coagulate the protein. Chromic acid may not, for this reason, be used together with gelatin, though the chromates of ammonium, zinc or nickel are suitable;

(c) The protein, which acts as a carrier for the inhibitor; and

(d) A bactericide which prevents putrefaction of the protein.

The protein employed may either be water soluble, *e.g.*, gelatin, casein or albumen, or at least soluble in alcohol. A clean surface is essential in this process and the coating may be applied either in one, two or three stages, after which the coating is exposed to light in order to decrease the solubility of the film in water.

In the one-stage process, an ammoniacal solution of casein and zinc-chromate may be used. On drying, the ammonia evaporates, leaving a residual hard and inhibiting film of zinc chromate. The process is, however, usually applied in two stages. By this method, the work is immersed into the protein solution, and after the film is dry, dipped into a chromate solution for ½ to 3 min., which both hardens and inhibits the film, after which the work is dried without prior rinsing. The chromate solution usually contains 0.5 to 2.0% of the chromate or 1 to 10% zinc, iron or nickel chromate. A longer treatment time or greater concentration of hardening agent is not recommended as it may disintegrate the protein film. Instead of the dichromates of heavy metals, amines, *e.g.*, diethylene triamine and tetraethanol-ammonium hydroxide, may be employed. In the three-stage process, the dried protein film is first hardened with formaldehyde, tannin or chrome alum, and is then impregnated by immersion in dichromate, but no specific advantage is obtained over the two-stage process.

Instead of an immersion treatment, the film may also be applied as a paint, which is produced by milling an insoluble chromate with a protein solution. The metal is then coated with this water paint, dried and hardened with an organic reagent or dichromate. The pigment may be a chromate of zinc, barium, strontium, or an amine or hydroxylamine, *e.g.*:

Casein	1 part
Basic chromate	3 "
Water	7 "

Alternatively, wax or rubber emulsions may be mixed with the solution of casein and zinc chromate.

The protein solution is prepared as follows: Gelatin is gently heated in water, or albumin may be stirred in

water at room temperature with or without the addition of 25 to 50 ml. per liter of ammonium hydroxide. Casein, on the other hand, is dispersed in water and is dissolved only by addition of 25 ml. per liter of ammonium hydroxide. The concentration of protein, depending on the required film thickness and the viscosity of the solution, is normally about 10%. On standing longer than one day, the solutions become less viscous, though gelatin solutions are unstable and tend on standing to become thick and ropy. Films produced in solutions containing more than 20% protein are too thick and may crack on drying.

While the use of water-soluble proteins retards the leaching of the film in humid atmospheres, insoluble proteins such as zein, produce films with better corrosion resistance, but are more difficult to apply as the bath must contain a stabilizer, a plasticizer, a corrosion inhibitor and a non-gelling compound, e.g., an amine. For example:

Zein	20 g.
Formaldehyde (40 per cent)	15 ml.
Ethyl alcohol	100 ml.
Dimethylglycol phthalate	10 g.
Dimethylamine	5 ml.
Chromic acid	1 g.

The film thickness varies with the protein employed and the solution concentrations, *e.g.*, a 10% solution which has aged 24 hours will produce film thickness of:

Egg albumin solution	0.00005 to 0.00015 in. (1.25 to 3.75μ)
Casein solution	0.0001 to 0.0004 in. (2.5 to 10μ)
Gelatin solution	0.0002 in. (5μ)
Normal chromate film	0.00003 in. (0.75μ)

The color of the film is yellow and transparent, unless opaque pigments are added. Ductility and adhesion are sufficient for the film to stand up when the work is bent, while the film is heat-stable up to 150°C.

The salt-spray corrosion resistance of the coating is very good, due to the slow rate of leaching of the chromate compared to other chromate films, though it is not suitable for use in very moist atmospheres. The authors state that after 11 days' salt spray, the coated metal gave better results than either oiled or even anodized work.

An advantage of the process is its cheapness, as solutions do not become exhausted or require replenishment. The coatings are excellent for use on aluminum parts which are to be stored.

Phosphate Processes

The origin of phosphate processes goes back in history to the Romans of the Third Century A.D.[50] In modern times, they were first applied on steel in 1859 and patented by T. W. Coslett in 1906,[51] who used a solution containing phosphoric acid and iron filings or ferrous sulphate. Zinc sulphate was added later with improved results.[51] These processes were soon followed by those of the Parker Company in 1918, who added primary manganous phosphate to the bath.

When aluminum is treated in dilute solutions of phosphoric acid, a very thin passive film is obtained similar to that obtained in chromatizing. The aluminum-phosphate film thus obtained gives improved paint adhesion and is usually preceded by an alkaline cleaning operation. It will be recalled that certain phosphoric-acid mixtures with organic acids and emulsifiers, as well as certain proprietary solutions are used for the purpose of cleaning the work as well as producing an aluminum-phosphate film on the surface to act as a paint base.

Recently the phosphate process has been adapted for use on aluminum.[52,53] While it is a complex process and more expensive than chemical oxidation, it produces rather more corrosion resistant coatings and forms a better paint base. An outstanding advantage of the process, both over chemical and anodic oxidation, is, however, the fact that it can be employed on mixed metal surfaces, containing large areas of iron, steel or zinc. The solution is broadly similar to those used for steel and zinc, and contains a metal acid phosphate solution, an oxidizing agent, as well as a complex fluor-

TABLE I

Production of Chromate-Protein Coatings

Method		*Bath Composition*		*Application*
Two step	(a)	Casein	100 g. per liter	Dip in (a) dry; dip 2 min. in (b), dry.
		Ammonium hydroxide (0.90)	50 ml. "	
		Potassium dichromate	2 g. "	
	(b)	Zinc dichromate*	50 g. "	
Two step	(a)	Egg albumin	100 g. per liter	Dip in (a), dry; dip 30 sec. in (b), dry.
		Ammonium hydroxide (0.90)	50 ml. "	
		Potassium dichromate	2 g. "	
	(b)	Chromic acid	20 g. "	
One step		Egg albumin	100 g. per liter	Dip, drain, dry.
		Ammonium hydroxide (0.90)	50 ml. "	
		Zinc dichromate†	20 g. "	
One step		Gelatin	100 g. per liter	Dip, dry.
		Ammonium dichromate	30 g. "	

*A 30 per cent solution is prepared by mixing a paste of 87 g. ZnO and 200 ml. water with a solution of 213 g. CrO_3 in 500 ml. water.

†The zinc dichromate in the form of a 20 to 30 per cent solution is treated with a minute quantity of NH_4OH to redissolve the ppt. before adding to other constituents.

ide, which accelerates the coating action. It also, however, contains other unpublished addition agents.

Broadly, the aluminum reacts with the phosphoric acid, activated by the nitrate and fluosilicate or fluoborate, the solution becoming locally saturated at the interface and an acid phosphate being deposited.[54] The surface finish is a crystalline iron-metallic phosphate coating which is an excellent base for paints, Patents covering two types of solution have so far been published, the earlier of which[52] contains an acid phosphate and a salt of a metal which forms an insoluble phosphate, *e.g.*, iron, manganese, zinc or cadmium, as well as an alkali fluoride and a silicofluoride. A typical example of this type of solution contains:

	g. per liter
Manganese dihydrogen phosphate	80
Manganese silicofluoride	500
Potassium fluoride	40

The solution is preferably applied with an inert material, such as Fuller's Earth, and a wetting agent such as starch or casein. After immersion, the solution is allowed to dry on the surface for 10 min., after which the residue is washed off.

The composition of the coatings obtained by this process varies with the operating conditions, but averages:—

	Per cent
Mn^{++}	31
PO_4^{---}	38
F^{-4}	6
Al^{+++}	0.1

As an alternative to Fuller's Earth, an inert material can be made by heating manganese silicofluoride, to leave a fluoride skeleton. The inert material reduces bubble formation during the coating process and is readily removable. If cadmium is employed instead of manganese, care must be taken not to use excess, as this may plate out on the metal surface.

The later process[53] which is the forerunner of the present-day processes employs a solution containing an oxidizing agent and a double fluoride, the former generally being 0.2 to 1.0% sodium nitrate, which is cheap and uncritical in its concentration, or sodium iodate (0.5 to 1.0%), potassium periodate (0.5 to 1.0%), potassium bromate (0.4 to 1.0%), quinone (1.0 to 2.0%), hydrogen peroxide (0.3 to 0.5%), potassium perchlorate (5.0 to 6.0%), sodium sulphite (0.2 to 0.4%) or potassium permanganate (0.012%).

The double fluoride used is generally a fluosilicate but may be replaced by fluoborate, fluotitanate, fluostannate, fluozirconate or fluovanadate.

As distinct from chemical oxidation, phosphating is carried out on a clean surface, and the work is therefore degreased before processing, is then immersed for 2 to 5 min. at 130 to 135°F. in the solution, after which it is rinsed in hot water, followed by a 30-sec. dip in 0.05% chromic-acid solution which is held at 150 to 170°C., after which the work is dried.

Alternatively, the work may be made more corrosion resistant by immersing in dichromate of which a larger concentration may be used, due to its greater stability. An example of a solution contains:[54]

	Per cent
Zinc (Zn^{++})	0.7 (wt.)
Phosphate (PO_4^{---})	1.0 "
Nitrate (NO_3^{-})	2.0 "
Fluoborate (BF_4)	1.0 "

The solution may be applied either by immersion or spray, the latter being applied in automatic machines which carry out the whole process. The sprayed coating is produced in 1 to 2 min. at 140 to 145°F., excess coating chemicals being removed in a water rinse for 20 to 60 secs., the usual chromic-acid rinse being applied before painting.

When working the solution, zinc phosphate, the oxidizing agent (sodium nitrate) and fluoride are consumed; replenishing salts are added to make good such losses and maintain a constant solution composition.

The coating consists mainly of phosphates, more basic than the dihydrogen phosphate and containing a little fluoride and aluminum, etc. Its weight varies between 0.1 to 0.5 g. per sq. ft. of surface area, depending largely on the pretreatment and type of metal being treated.

Some compositions of coatings found by chemical analysis are given in Table II.

Coatings can be produced on zinc and steel and its alloys, as well as mixed metal surfaces, *e.g.*, aluminum-base, sand-pressure dies and gravity die-castings, zinc-base die-castings, as well as wrought aluminum alloys, cast iron and cold-rolled steel. It has recently found application in such articles as typewriters, calculating machines, mixers, furniture, scales, motor-car components, refrigerators, metal walls, and many other types of work.

Comparison of Chemical Oxide Conversion Coatings

While chemical conversion coatings appreciably improve the corrosion resistance of aluminum surfaces, no detailed data of the comparative value of different processes are available. In practice, the most important application of both chemical oxide and phosphate coatings is as a paint base, while little practical work has been done on the dyeing of chemical oxide films or of electroplating on them.

The chemical oxide coatings, with the exception of those produced by some of the lesser known and more complex processes, are soft and will not stand up well to wear and abrasion.

With the exception of the E.W. and Alocrom process again, the color of the coatings is generally unattractive and dyeing is difficult and not to be compared in color and light fastness with color-anodized work.

Where aluminum is to retain its natural color, only the E.W. process is applicable, and it may well be that this has not yet had the attention in this country that it deserves.

Phosphate coatings have better corrosion resistance, but are more complicated and costly to produce. For instance, comparative figures for the Pylumin and Bonderizing processes, both of which are marketed by the same firm in England, give the cost of the former process as approximately 1/20th penny, and that of the

TABLE II

Composition of Phosphate Coatings[55]

	Immersion			*Spray Bonderizing*		
	2S	*24S-T*	*Steel*	*2S*	*24S-T*	*Steel*
Constituents* (per cent):—						
Zinc (Zn^{++})	37.0	32.5	31.4	38.1	32.9	39.8
Phosphate (PO_4^{---})	37.2	38.8	42.1	41.8	35.7	41.0
Fluoride (F^-)	2.7	4.1	1.4	1.9	3.3	1.9
Aluminum (Al^{+++})	1.2	3.2	—	1.0	3.0	—
Iron (Fe^{++})	0.4	0.4	8.2	1.8	1.5	4.2
Copper (Cu^{++})	—	3.7	—	—	4.6	—
Magnesium (Mg^{++})	0.1	0.4	—	0.3	1.0	—
Chromium† (Cr^{++})	0.04	0.03	0.1	0.4	0.8	0.7

*The remainder (up to 100%) is water, part of which is hydrated to the zinc phosphate.
†The presence of chromium is due to the chromic acid rinse.

latter process at 1/10th of a penny per sq. ft. of surface treated. Both processes compare very favorably for many applications against anodic treatment, which in many cases costs up to 3d. to 4d. per sq. ft.

Where the operation itself is concerned, chemical oxide treatments do not require as much cleaning and surface pretreatment as phosphating which requires a clean surface, and, due to the complex solution required, the control of the latter is somewhat more difficult.

The phosphate coatings are grey in color, and are the only recognized means of adequately protecting mixed metal surfaces which contain large areas of zinc or steel as well as aluminum.

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Science for Electroplaters

I. Changes in a Plating Bath

By L. Serota

The author received his B.S. degree from the Brooklyn Polytechnic Institute, following which he spent seven years as operating supervisor in chemical industries. He has been an instructor in Industrial Chemistry at Brooklyn Technical High School for twenty-five years. There, he organized an evening course in electroplating in 1950 for those associated with the industry in the New York Metropolitan area. The free course is part of the Adult Education program conducted by the Evening School Division of the Board of Education of the City of New York.

OPERATING a plating tank brings up many questions which are seemingly difficult to explain. How often do we seek an answer to such questions as the following: Why, during plating operations, will a green nickel salt added to the nickel tank deposit as metallic nickel on the cathode? Why, similarly, will the blue copper sulphate crystals added to an acid copper tank appear as metallic copper on the cathode, or the red chromic acid solution of the chromium bath yield metallic chromium on the cathode? Why will sodium carbonate continue to form in any sodium cyanide bath or, in what manner does carbon treatment help improve the metal deposit? Why will some bright nickel baths require the addition of a wetting agent instead of hydrogen peroxide to prevent pitting? How does a corrugated metal strip attached to the cathode aid in removing such impurities from a nickel bath as copper, lead, iron, and zinc?

To the inquiring mind the questions that arise seem endless. Science has found explanations for many of these changes. A good deal remains to be learned, however, before many of the remaining operating troubles relating to plating can be overcome. Many of these difficulties serve as the basis for investigation throughout the world. Major programs for such projects are sponsored in the U. S. by *The Electrochemical Society* and the *American Electroplaters' Society*. Results of such investigations are published in the respective journals of the societies.

Another valuable source for literature relating to such developments is the publication METAL FINISHING. The January 1955 issue, for example, contains an excellent comprehensive survey of the finishing trade and patent literature abstracted by the editor, Mr. Nathaniel Hall, under the heading "Technical Developments of 1954." Developments in this article are described under such headings as cleaning, polishing, barrel finishing, aluminum plating and anodizing, metal coatings and similar topics. This is an annual feature, and is representative of the articles appearing in this publication.

To appreciate the scope of such studies, to understand the reports recorded in the various journals related to electroplating, requires an understanding of the basic terms used in this field of science. The first terms to consider are those dealing with the changes occurring in the plating baths. The changes involved are classified as *physical* changes and *chemical* changes. When a substance will change in form but will not lose its properties it is said to undergo a physical change. The term properties refers to the characteristics by which matter is identified, such as color, taste, solubility, density, freezing point, boiling point, conducting of current (conductivity), magnetism, and surface tension. Of special importance to the plating industry are such physical properties of the plated coating as tensile strength, elongation, hardness and brightness.

Copper can be readily identified by its color, an outstanding characteristic. Before identification can be confirmed, however, several additional tests must he made, such as hardness, conductivity, and density. If samples of aluminum and silver are compared, it is not difficult to distinguish between them, since the characteristic of density will show effectively that the sample of silver will be about four times as heavy as aluminum. When barium carbonate is added to a chromium plating solution to reduce the amount of sulphuric acid, a product barium sulphate forms after several stages. This substance does not dissolve and settles to the bottom of the tank. In this example, the characteristic of solubility is utilized for the control of the bath. A liquid can readily be identified as water if it boils at 212 degrees Fahrenheit at sea level or freezes at 32 degrees Fahrenheit. Muriatic acid can be distinguished from sulphuric acid by its characteristic choking odor.

Physical Changes

Physical changes occurring in the plating operations are varied and numerous. A few examples will help to understand this type of change:

When nickel chloride is dissolved it is considered a physical change because the salt remains unaltered. In solution the particles are merely reduced to a very fine size. If a sample of solution is removed and the water evaporated, the salt is recovered without loss of its properties.

Grinding or crushing a salt to smaller size or powder is considered a physical change, because the particles retain the properties of the original lump or crystal.

Polishing, buffing, burring, or barrel finishing constitute physical changes because only surface metal is removed. The degree of surface removal will vary with the method employed.

Cleaning mixtures are used to remove soil. Where the oil is not a fat, as for example a petroleum product (hydrocarbon), removal is accomplished by changing the surface tension of the solution. In this manner the oil film on the metal surface is displaced. Materials capable of producing this physical change, lowering the surface tension, are known as surface active agents, surfactants, or wetting agents. Solid dirt particles on metal surfaces are removed by the same principle.

Degreasing action may be accomplished by immersing the metal in the

solvent or by solvent vapor treatment. Trichlorethylene and perchlorethylene are commonly used as grease solvents. The solvent action again constitutes a physical change. The solvent is purified by distillation, during which process it changes from liquid to vapor and then condenses back to liquid again. Since the oil or grease is not carried over during this process, the change from liquid state to vapor state and then back to liquid again is considered a physical change.

Evaporation of water from the tank represents a change in physical state only, that is from the liquid to the vapor state. When water is added to replace that which has evaporated, the composition of the bath does not change.

When dry ice (solid carbon dioxide) is added to an anodizing tank, it changes to a gas, but remains as carbon dioxide. In this example the dry ice changed directly from the solid state to a gas without change in properties.

In a carbon treatment the activated carbon is capable of attracting to its porous surface a molecular layer of finely divided suspended particles and addition agents present in the tank. This process is known as adsorption, a physical characteristic. Another application of this principle of adsorption is the use of complex organic materials as pickling inhibitors. These substances are adsorbed selectively on the steel during the pickling process. One effect is to lower the surface tension, which favors the release of the bubbles of hydrogen, thereby minimizing hydrogen embrittlement, a condition that is usually associated with overpickling.

The removal of excess sodium carbonate from the commonly used sodium cyanide plating tanks can be accomplished by cooling the solution in the tank to 32°F. or lower. A temperature of 26 degrees is considered the most effective. This is called the freezing out method. The process does not apply to the potassium cyanide baths. At this low temperature, sodium carbonate is not as soluble as it is at tank operating temperatures, hence most of it settles out and can be removed by decantation and filtration. This method, however, will remove only the sodium carbonate present in excess of 5 to 6 ounces per gallon. The difference in solubility of sodium carbonate at the temperatures indicated is a physical property. Other methods for the removal of excess carbonate will be discussed under the topic of chemical changes.

Chemical Changes

The second term in the classification refers to changes wherein the properties and composition by which a substance is identified are changed and a substance with entirely new properties is formed. Such a change is defined as a chemical change. Plating operations provide ample instances of such changes.

The alkali in the cleaning bath will react with fats and some oils present on the metal to form a soap. This chemical action is called saponification. The newly formed soap is soluble in the cleaning solution and possesses the property of lowering the surface tension, thereby aiding in the formation of an emulsion with the oils.

Pickling steel involves the removal of the rust (iron oxide) and scale by treating the metal with hydrochloric acid (muriatic acid) or sulfuric acid. The acid reacts with the rust, changing it to a substance that dissolves. The scale is cleaned away by the chemical action of the acid on the steel, during which process the liberated hydrogen aids in lifting off the scale. Pickling and bright-dipping of copper and copper-rich alloys are also performed to remove the oxide film by chemical action. The film may range from tarnish to heavy black scale.

Most metals when exposed to pure air will quickly develop a film of oxide. Nickel and chromium are examples of this change. Passivity of metals is usually associated with this condition. The problem of its effect on plating has been the basis of extensive investigation.

When barium carbonate is added to a chromium solution it reacts with the sulfuric acid. As a result of this chemical change a new substance, barium sulphate forms, which does not dissolve. This insoluble material settles to the bottom of the tank. By this change, the amount of sulfuric acid in the solution can be kept within the limits allowed for satisfactory chromium plating. Another example of chemical change for this tank can be shown by the brown coating (lead peroxide) that forms on the lead anodes during operation. When the anodes remain suspended in the tank and unused, the brown coating will change chemically to a yellow coating that is called lead chromate. A dummy cathode is frequently used to remove the lead chromate and allow lead peroxide to reform. The lead peroxide on the anode aids in changing the trivalent chromium to chromic acid by an electrochemical process known as oxidation. This is an important step in the operation of the chromium tank, since trivalent chromium will affect the deposit if present in such small amounts as several grams per liter. Operation of the chromic acid bath results in the formation of large volumes of oxygen and hydrogen, a chemical change. The liberation of these gases will cause a chromic acid spray to escape. This is decidedly a health hazard, since the chromic spray will attack the mucous membranes of the nose and throat.

The use of hydrogen peroxide in the nickel bath involves chemical changes affecting such contaminants as iron and some organic matter. If the bath permits, iron is changed chemically (oxidized) by the hydrogen peroxide. In this form the iron will settle out (precipitate) as reddish brown iron (ferric) hydroxide, when the pH is 4.0. Since some brighteners belong to a class of organic materials that are decomposed (chemically changed) by hydrogen peroxide, its use in such bright nickel baths is not satisfactory. Copper, zinc and iron impurities can be removed by raising the pH of the bath. By this method the metals will settle out as hydroxides. Control of the pH, however, is important, because nickel will also be lost from solution as an insoluble hydroxide if the pH exceeds 6.5. It is advisable, therefore, to oxidize the iron with hydrogen peroxide, whenever the bath permits, so that precipitation of iron as the hydroxide can occur at a lower pH. Increasing the pH of the bath is accomplished by adding nickel carbonate or nickel hydroxide to the tank.

The change from the green color of nickel ion in the solution to a metallic deposit on the cathode is an example of an electrochemical change known as reduction. This is also true for all cathode depositions. This principle of deposition (electrolysis) provides a very effective method for removing copper, lead, zinc, and iron impurities from a nickel bath. By using a corrugated or V shaped cathode, iron and zinc will be deposited on the ridges of this strip while copper and lead will be deposited in the grooves. This electrochemical process for removing impurities is known as dummying. The

(*Continued on page* 83)

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Raising pH in Watts Nickel Bath

Question: We have made up a nickel solution of the high pH Watts type and find that our pH is only 4.0. How can we raise it?

J. B. R.

Answer: The most effective method of raising the pH is to draw a slurry of nickel carbonate into the filter, then circulate the plating solution through it. The solution can be tested at regular intervals and, when the pH has reached the desired figure, the filter is stopped. This avoids addition of nickel carbonate to the solution, which would result in rough deposits, and eliminates the possibility of adding excess carbonate.

Powdered chalk can be used instead of nickel carbonate but ammonia or caustic must not be added to a Watts bath.

Bright Acid Copper

Question: On page 272 of your 20th edition of the *Guidebook* you outline the "General Motors Bright and Semi-Bright process" of depositing copper from an acid copper bath. Could you advise us of the exact brightener and wetting agent which are used in this bath?

S. F.

Answer: The solutions suggested by Clifton & Phillips (*Metal Fin.*, **40,** 457 [1942]) contained the following:

	Semibright	*Bright*	
Copper sulfate	250	210	g./l.
Sulfuric acid	10	30	"
Thiourea	0.01	0.04	"
Molasses	—	0.80	"
Wetting agent	0.20	—	"

The suggested wetting agent was Triton No. 720, sold by Rohn & Haas. Patents on the process are owned by General Motors Corp.

Electroformed Masks

Question: I have heard of several outfits using electroformed masks for spraying different plastics and metals. We are doing this type of work, but we make our masks of Durez resins. I would appreciate any information or a source of information you could give us on the process of electroforming masks. We have our own plating department, but as yet are not familiar with the electroforming process.

F. S.

Answer: Electroformed masks are prepared by metallizing non-conductors, followed by acid copper plating to produce the shell, which is then cut out, as required. The metallizing procedure will be found on page 358 of the 1955 edition of the METAL FINISHING GUIDEBOOK.

If a metal model is used, a stripping film is applied before plating to permit removal of the electrodeposited shell. A customary procedure is to nickel plate the model, then immerse in a weak solution of sodium dichromate to produce the film, after which acid copper plating follows. Electroformed masks are produced by a number of specialists in this field. A list will be found on page 54 of the October, 1954 issue of ORGANIC FINISHING.

Nickel Plate on Steel

Question: We have a 7/16-20 stud of steel approximately 1" long to be nickel plated to a standard class 2 Go-No Go gauge. It allows approximately .0005" to .0007" plate. We have a standard 7/16-20 hex nut of steel with the same gauge requirements. Internally, about .0004" to .0007" is deposited. Our plating specifications call for a low pH Watts type bath with no brightener added. The studs and nuts are wired (not barreled) to prevent thread damage. The end use of this item is an outdoor all-weather application. All of which leads to a rusting condition when the nut and stud are installed.

We feel that a minimum nickel deposit of .001" on the minor diameters of the stud and nut would prevent rust. This would require a change in design of both nut and stud but would be satisfactory if we could be sure a .001" nickel deposit would solve the rusting. No copper flash or plate is permissable. Do you feel that .001" nickel would protect this item? If not do you have any alternative? We have discussed stainless and cadmium. Both are functionally objectionable. Pure nickel would be a perfect solution to the problem, but is much too costly.

R. A. C.

Answer: The protective value of nickel plate depends not so much on thickness of deposit as on absence of porosity. Therefore, it is essential that the nickel plating solution be carefully filtered and the anodes bagged for best results.

As to whether 0.001" deposit will eliminate rusting, this is a question which has no answer, since it is necessary to know the conditions of exposure and the period of time desired before rusting commences, which it eventually will under any circumstances.

Rather than redesign the nuts and studs to allow for the heavier deposit, it may be more desireable to apply the nickel coating by the "electroless" method since the deposit would be uniform within about 10%. Details will be found on page 408 of the 1955 edition of the METAL FINISHING GUIDEBOOK.

Electopolishing Brass

Question: We wonder if your department could help us with the following problem. Is there an electrolytic process for polishing small brass parts

in large quantities? What equipment would be necessary?

L. D.

Answer: Electropolishing of small parts in bulk is ordinarily considered impracticable because of the relatively high current densities involved. However, you can check with suppliers, a list of same appearing on page 548 of the 1955 edition of the METAL FINISHING GUIDEBOOK-DIRECTORY.

Bright dipping, or chemical polishing, may be more suitable, and a list of distributors of the newer type baths is enclosed. Patents are held by Battelle Development Corp.

In any case, it should not be expected that the finish, by either process, will equal that of hand polishing or ball burnishing.

Ormolu Gold Finish

Question: Can you please advise me as to how a "gold ormolu" finish can be made on gold plated articles. I have looked up a number of references but have been unable to find the answer.

J. K.

Answer: This finish requires a good gold plate since a thin flash gold deposit may not withstand the heating. After plating, the article is scratch brushed and the following paste is applied to the recesses:

Potash alum (aluminum potassium sulfate)	50 parts
Red ochre	17 "
Zinc sulfate	10 "
Sodium chloride	3 "
Potassium nitrate	20 "
Water	To make a paste

Heat at about 220 deg. F. until the paste begins to discolor. Then allow to cool, rinse, and scratch brush with a weak solution of vinegar or sulfuric acid.

A cheap ormolu finish may be obtained by matte dipping brass or heavily copper plating soft metals, followed by a bright dip. Then gold plate.

ALKALI METALS IN PHOSPHATING AND CYANIDE PLATING BATHS

The following addition to Mr. Gabrielson's article, "Alkali Metals in Phosphating and Cyanide Plating Baths," arrived too late for insertion in the February issue. These observations on the regeneration of the ion exchanger belong on page 59, immediately preceding the section headed "Experimental." — Ed.

When the resin had been used several times for the analysis of the complex cyanide solutions it was noticed that the capacity of the ion exchange layer was diminished. When the cyanide solutions passed through the column, the color of the resin darkened and the original color was not restored by sodium hydroxide treatment. This treatment was therefore not sufficiently effective to remove the adsorbed complex cyanide ions. The regeneration was, therefore, performed in the following manner: the resin was treated with an excess of 1N sulfuric acid in a beaker (caution: risk of hydrogen cyanide evolution). After-

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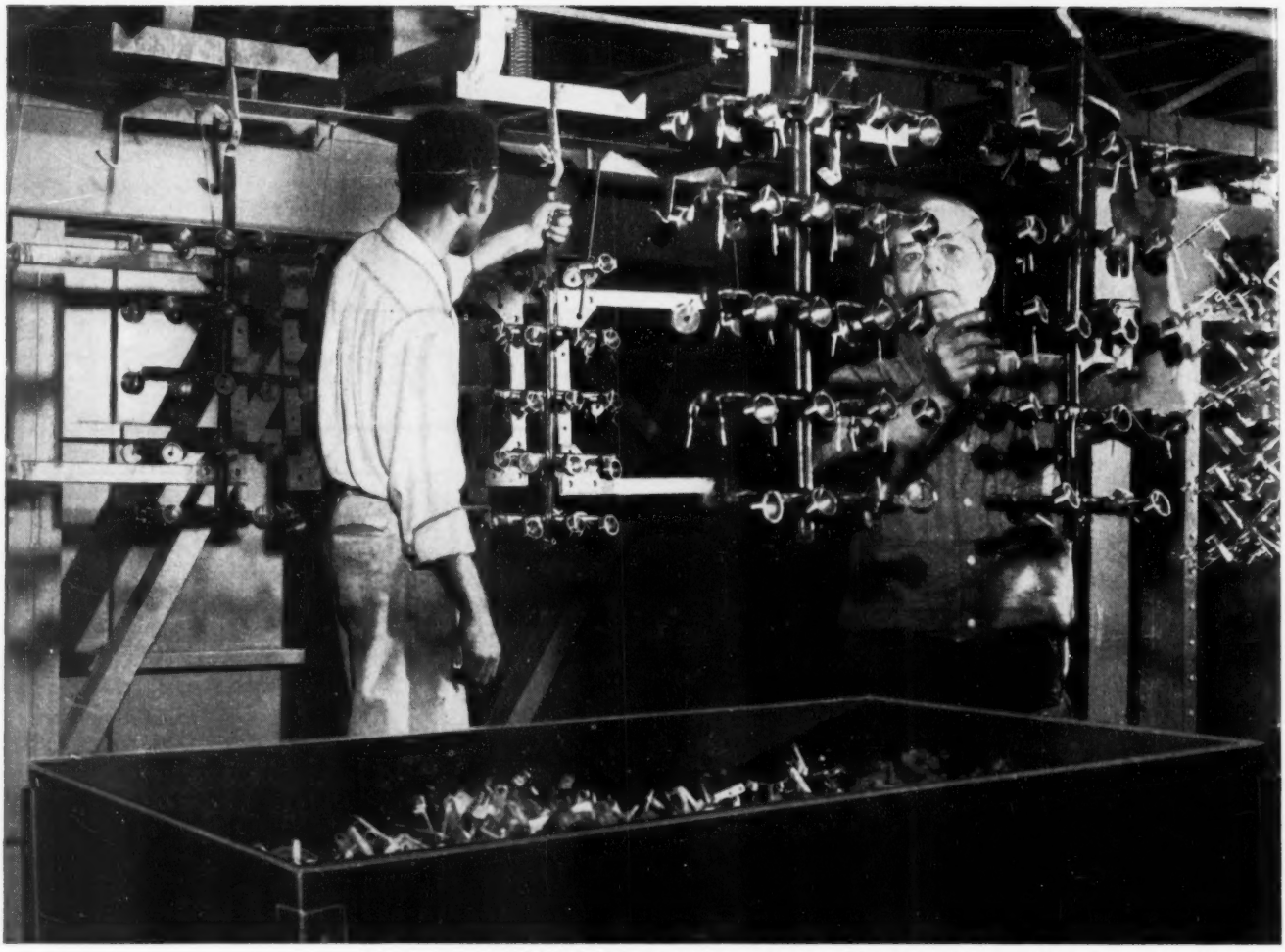

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To get reject-free cleaning and lower costs Aetna Electroplating uses Pennsalt Electrocleaners

Cleaner efficiency and economy is checked daily at Aetna Electroplating Company. Pennsalt Cleaners K-2 and K-7 were found to cost less and last longer with minimum consumption.

A job plater can't take a chance on his cleaning cycle—it *must* be effective on all of the various soiled parts coming into his shop. That's why Aetna Electroplating Co. of Philadelphia chose Pennsalt Cleaners exclusively for their new double-row Udylite automatic plating machine.

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How did Aetna select this successful combination of metal cleaners? By talking *results*, *properties*, *costs* with their Pennsalt Metal Processing Specialist. Can we do the same for you? Call or write: Metal Processing Dept., Pennsylvania Salt Manufacturing Co., EAST: 1012 Widener Bldg., Philadelphia 7, Pa. WEST: 2168 Shattuck Ave., Berkeley 4, Calif.

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Contact your local distributor directly, or write: Metal Processing Department, Pennsylvania Salt Mfg. Co., 1012 Widener Bldg., Philadelphia 7, Pa.

Pennsalt Chemicals

wards the resin was poured into the column and treated with 200 ml 4N ammonium hydroxide, after which the exchanger was washed with distilled water until neutral reaction of the effluent.

It must be pointed out that this treatment is necessary only when the resin has adsorbed complex cyanide ions. In order to regenerate the ion exchanger when phosphate ion has been adsorbed the treatment with 1N sodium hydroxide is sufficient.

SCIENCE FOR ELECTRO-PLATERS

(*Concluded from page 79*)

use of the Hull Cell for the study of plating operations is a striking example of an application of this principle of varying current densities.

Lead may be introduced as an impurity in the nickel tank if used for heating coils, because nickel chloride reacts with the lead. The product formed (lead chloride) dissolves in the solution. If the nickel chloride exceeds 8 oz./gal., glass or other heating coil elements are recommended.

The accumulation of sodium carbonate in cyanide plating baths is due to the chemical changes that take place between the caustic soda (sodium hydroxide) and sodium cyanide in the tank and the carbon dioxide and oxygen from the air. High temperatures and agitation are contributing factors to a more rapid formation of sodium carbonate as well as additional products, such as ammonia and salts of formic acid. The odor of hydrocyanic acid over a freshly prepared solution of an alkali cyanide is due to the chemical action between the sodium cyanide and water. This chemical change is known as hydrolysis. The amount (concentration) of hydrocyanic acid present is very small. Ammonia and sodium carbonate also form at the anode as a result of electrochemical action (oxidation). Removal of excess sodium carbonate as described under physical changes may be accompanied by the freezing-out method.

Chemical treatment for the removal of carbonates depends upon the formation of an insoluble carbonate compound that will precipitate. This change may be produced by the addition of calcium sulfate, calcium hydrate (hydroxide) or barium hydrate (hydroxide). Calcium carbonate or barium carbonate are the compounds that form by this treatment. One investigator recommends the use of calcium carbide as a carbonate remover. Calcium carbide changes chemically to calcium hydrate when added to the solution. The use of each reagent has its advantages and disadvantages. Calcium hydrate as the precipitating agent has been stated to be the most efficient and simple method for the removal of excess carbonate from either the sodium or potassium cyanide baths.

Disposal of cyanide wastes from plating processes presents an added operational problem due to the toxicity of this waste. The fact that exceedingly small amounts, quantities as low as .025 parts per million, have been found to be toxic to fish — and that as little at .048 per cent in the air is dangerous to life without respiratory protection, presents a challenge to industry for the development of adequate methods of treatment of this toxic waste. This subject evoked editorial comment in METAL FINISHING to the effect that "the long range viewpoint would seem to indicate that, in most highly industrialized and populated areas at least, the treatment of toxic wastes will become a municipal and not an industry responsibility."

Several chemical methods have been developed for the elimination of this waste. One method involves the addition of an acid to the waste solution, thereby reducing the pH to a value at which the cyanide will be present as hydrocyanic acid. This is removed by blowing air through the solution (aeration) or sending steam through the batch. The toxic gas is thus sent into the air where the amount present (dilution) becomes low enough to eliminate the danger of a health hazard. This disposal method is known as batch volatilization. Another chemical procedure, known as the ion exchange process, permits the removal of the cyanide compound by sending the waste solution over a bed of ion-exchange resins. The remaining liquid (effluent) is water of relatively high purity. This process of ion exchange is finding an ever widening use in the plating industry. Cyanide wastes can also be treated with ozone under controlled conditions. This chemical reaction is known as oxidation. Elimination of cyanide waste by a method described as efficient and economical can be effected by adding chlorine (chlorination) at controlled pH's above 8.5 in amounts of approximately 4 parts per million of chlorine to one part of the cyanide present.

Patents

Recently Granted Patents in the Metal Finishing Field

Method of Deburring and Finishing

U. S. Patent 2,684,562. *July* 27, 1954. *W. G. Balz and C. H. Castle, assignors to Roto-Finish Co.*

The method of finishing parts comprising the steps of supporting a mass of abrasive aggregate with the mass submerged in a liquid in a cylindrically walled container, supporting the parts to be treated in a plurality of spaced groups, the parts constituting a group being supported in vertically aligned spaced substantially fixed relation relative to each other, and submerging the groups of parts in the mass of abrasive aggregate and while submerged simultaneously oscillating the groups through an arcuate path the stroke of oscillation being less than 360°.

Collapsible Valve for Sandblast Hose

U. S. Patent 2,684,559. *July* 27, 1954. *H. A. Greiser.*

A valve for controlling an air blast line comprising an open ended barrel having an outwardly extending annular flange between its ends provided with diametrically opposed axially aligned passages, a tubular collapsible rubber hose disposed within said barrel, a pin in each of said passages with its inner end disposed to bear against said hose section for collapsing the same, the outer end of each pin extending beyond the periphery of the annular flange on said barrel, a hemispherical gripping member mounted on each of said pins and guided for sliding movement on said annular flange for urging said pins toward the axis of said barrel, resilient pads disposed between said hemispherical gripping members on diametrically opposite sides of said barrel for yieldingly maintaining said hemispherical gripping members in spaced apart position, each said hemispherical gripping member having a chordal face adjacent each open end of said barrel provided with inner and outer flanges disposed for concentric alignment with the axis of said barrel, and retaining means threadedly mounted on the ends of said barrel and having an annular flange cooperating with said inner and outer flanges on said hemispherical gripping members for limiting inward and outward movement of the latter relative to each other, one chordal face on each hemispherical gripping member having a keeper groove formed therein adjacent its outer flange so as to receive the annular flange of the adjacent retaining means for locking said hemispherical gripping members together against the action of said resilient pads.

Ferric Chloride Etching Solutions

U. S. Patent 2,684,892. *July* 27, 1954. *T. A. Saulnier, assignor to Radio Corp. of America*

An etching composition comprising a water solution of ferric chloride having a specific gravity of 35° to 48° Baumé, 20 to 50 grams per liter of a substance selected from the group consisting of ammonium persulfate, alkali metal persulfates and a mixture of ammonium and alkali metal persulfates, and 2% to 10% by volume of a substance selected from the group consisting of concentrated hydrochloric acid, concentrated nitric acid, and a mixture of hydrochloric and nitric acids.

Gas Plating

U. S. Patent 2,685,124. *Aug.* 3, 1954. *H. A. Toulmin, Jr. assignor to The Commonwealth Engineering Co. of Ohio*

The method of depositing elementary metals in the solid state upon other base metals from a heat-decomposable metal carbonyl compound and bonding the same thereto which comprises, subjecting the base metal to a vacuum atmosphere of between 18″ and 23″ of mercury ,elevating the temperature of the base metal to between about 350° F. and 400° F., thereafter subjecting the base metal while at said elevated temperature and under said vacuum atmospheric conditions to gaseous metal carbonyl which is decomposable at the temperature of said base metal, said gaseous metal carbonyl being delivered under pressure of from 10 lbs. to 15 lbs. per square inch whereby said carbonyl is caused to decompose and deposit elementary metal on the base metal.

Gas Plating

U. S. Patent 2,685,532. *Aug.* 3, 1954. *P. Pawlyk, assignor to The Commonwealth Engineering Co. of Ohio*

A process of plating a metallic object with chromium comprising the steps of heating the object to be plated to a temperature above the decomposition point of gaseous chromium hexacarbonyl, and contacting the heated object with heat-vaporized flowing gaseous chromium hexacarbonyl in an atmosphere containing an inert carrier gas at substantially atmospheric pressures the temperature of the gases and the object being of such a nature that the hexacarbonyl decomposes to deposit metal on the object.

Anodizing Aluminum

U. S. Patent 2,685,563. *Aug.* 3, 1954. *G. G. Gauthier, assignor to Pechiney-Compagnie de Produits Chimiques et Electrometalurgiques*

A method for the electrolytic superficial oxidation of aluminum and alloys containing at least 90% aluminum which consists in immersing the article to be oxidized in a bath through which is passed an electrical current having an alternating component, said bath containing sulphuric acid and at least one compound selected from the class consisting of alkali metal chlorides, bromides, and iodides, alkaline-earth metal chlorides, bromides and iodides, and hydrochloric hydrobromic, and hydroiodic acid in such proportions that the total content of halogen elements in said bath is in the range from 0.1% to 20% by weight.

Gas Plating

U. S. Patent 2,685,535. *Aug.* 3, 1954. *H. Nack, assignor to The Commonwealth Engineering Co. of Ohio*

A method of coating an electrically conductive workpiece comprising the steps of supporting the workpiece within a chamber, creating an electrostatic field within said chamber and having said workpiece connected as the cathode, conducting a gaseous metal carbonyl in contact with radioactive material and thereafter conducting said gaseous metal carbonyl through said chamber and in contact with said workpiece.

Electrolytic Cleaning

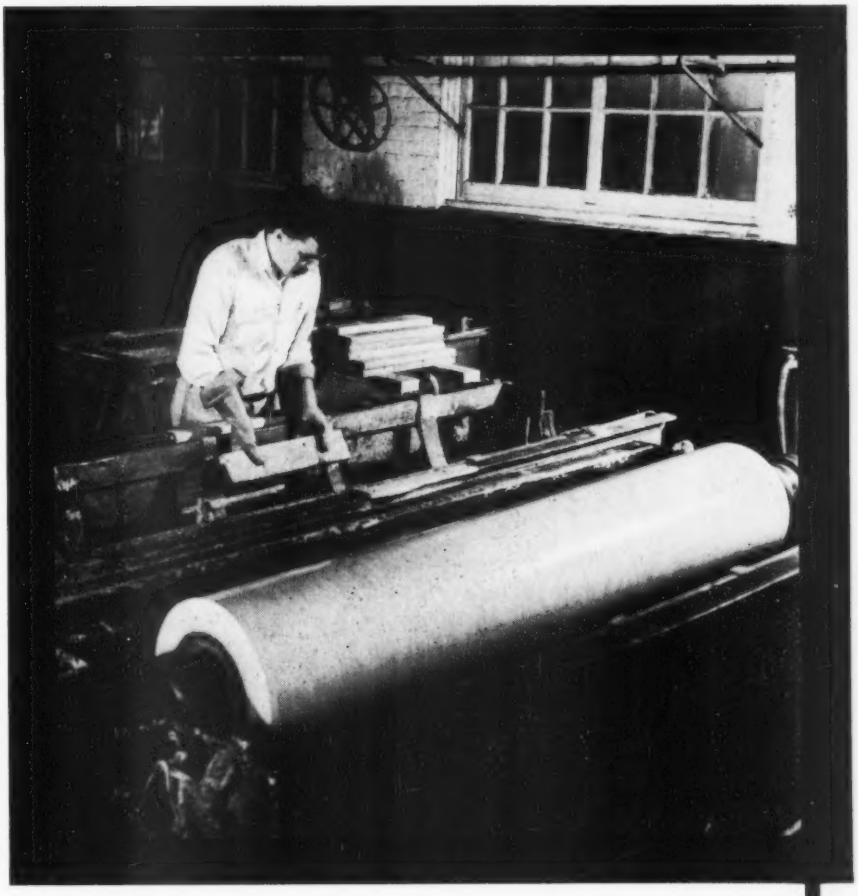
U. S. Patent 2,685,564. *Aug.* 3, 1954. *R. A. Emmett, Jr. and W. H. Petering, assignors to Detrex Corp.*

In a process for the electrolytic cleaning of smut-like materials from metal articles in which the article serves as one of the electrodes, the steps which comprise immersing the surface to be cleaned in an aqueous solution of a cleaning compound selected from the group consisting of the polyphosphates, citrates, mono phopshates, acetic acid-acetate mixtures, bicarbonates and dichromates, said solution having a pH of approximately 3.5 to approximately 10, and passing an asymmetric reversing electric current through said metal and through said solution, the relative current values being such that the total quantity of positive electricity passed is greater than the total quantity of negative electricity passed, the ratio of time of application of positive current to time of application of negative current being in the range of 2:1 to 8:1.

Hot Dip Coating

U. S. Patent 2,686,135. *Aug.* 10, 1954. *J. E. Butler, assignor to National Steel Corp.*

In the hot dip process of coating a metal sheet with a layer of metal, the steps comprising, passing such a sheet through a bath of molten metal to coat the sheet and then passing the coated sheet upwardly through a layer of liquid on the bath, the coating metal on the sheet in the layer of liquid being molten and the liquid being a nonsolvent for the molten metal, and rapidly vibrating the trailing edge



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of the sheet in the liquid layer to remove excess molten coating metal while the sheet is suspended with its trailing edge free to vibrate in the layer of liquid.

Porcelain Enamel

U. S. Patent 2,686,131. *Aug.* 10, 1954. *M. Combs, assignor to Vitreous Steel Products Co.*

A coating composition for use in producing colored fused enamel coatings comprising from 4 to 1 parts of a fusible frit selected from the class of opaque titanium, zirconium, and antimony frits mixed with from 1 to 4 parts of a clear fusible antimony frit as the essential fusible constituents and a relatively small amount of a vitreous enamel color compound.

Hot-Dip Aluminum

U. S. Patent 2,686,354. *Aug.* 17, 1954. *H. Lundin.*

The method of coating and joining together metal shapes of a base metal selected from the group consisting of cobalt, chromium, nickel, iron, and alloys thereof, which comprises thoroughly cleaning the surfaces of said shapes that are to be joined together, positioning such surfaces in substantially abutting relation, then applying to such cleaned and substantially abutting surfaces a flux selected from the group consisting of fluoride compounds of zirconium and fluoride compounds of titanium, then applying molten aluminum to and between such surfaces, and then cooling the aluminum so applied, whereby a continuous tightly adherent coating of aluminum is formed on and joins together said substantially abutting surfaces.

Hot-Dip Aluminum

U. S. Patent 2,686,355. *Aug.* 17, 1954. *H. Lundin.*

The method of forming a continuous tightly adherent coating of aluminum on a base metal selected from the group consisting of cobalt, chromium, nickel, iron, and alloys thereof, which comprises thoroughly cleaning the surface of said base metal, then applying to such cleaned surface an effective amount of a flux selected from the group consisting of fluoride compounds of titanium, and then contacting such surface of the base metal with molten aluminum.

Bright Dipping Aluminum

U. S. Patent 2,687,346. *Aug.* 24, 1954. *L. McDonald, assignor to Kelite Products, Inc.*

A process of brightening the aluminum or aluminum alloy skins of aircraft which comprises, treating the skins of aircraft with an aqueous solution containing essentially polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid, phosphoric acid, and an aryl sulfonic acid, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, and the aryl sulfonic acid containing less than 4 alkyl carbon atoms.

Chromium Plating

U. S. Patent 2,686,756. *Aug.* 17, 1954. *J. E. Stareck and R. Dow, assignors to United Chromium, Inc.*

A method of electrodepositing crack-free, chromium plate on an article of metal which comprises essentially: passing current in the range of 0.5 to 8 amperes per square inch from an anode to said article as a cathode immersed in an aqueous chromium plating bath at a temperature of 140°F. to the boiling point of the bath, said bath comprising essentially 200 to 900 g./l. CrO_3, strontium sulfate and an alkali metal silicofluoride each in an amount sufficient to saturate said bath and to provide therein an undissolved residue of strontium sulfate and alkali metal silicofluoride, respectively, said alkali metal being selected from the class consisting of potassium compound in an amount sufficient to adjust the concentration of the strontium sulfate in solution in said bath to 0.3 to 5.5 g./l. of sulfate ($SO_4^=$), and a soluble non-

catalytic alkali metal compound in an amount sufficient to adjust the concentration of the alkali metal silicofluoride in solution in said bath to 1.0 to 11.4 g./l. of silicofluoride ($SiF_6^=$), the sum of said dissolved sulfate and silicofluoride being in the range of 1.5 to 11.7 g./l., said sum of dissolved sulfate and silicofluoride varying with the CrO_3 concentration in the manner defined by the area ABCD of the graph shown in the accompanying drawing, the alkali metal of said non-catalytic compound being the same as the alkali metal of said alkali metal silicofluoride.

Copper Plating Steel Wire

U. S. Patent 2,686,859. *Aug.* 17, 1954. *A. N. Gray and G. E. Murray, assignors to Western Electric Co.*

The method of making an electrical conductor having a steel core covered with a highly conductive layer of copper, which comprises impressing a cathodic charge upon a moving steel wire, continuously advancing the cathodically charged wire longitudinally through a series of electrolytic cells containing a copper-plating electrolyte to successively plate a plurality of thin layers of copper thereon, then impressing an anodic charge upon the plated wire, continuously advancing the anodically charged wire through an electrolytic cell containing a copper electrolyte, maintaining in said cell an anode current density sufficient to deplate from the wire during its passage through said cell from about 5% to about 10% of the previously electrodeposited layers of copper, then impressing a cathodic charge upon the partially deplated wire, continuously advancing the wire through another series of cells containing a copper-plating electrolyte to deposit another plurality of layers of copper thereon, and continuing to subject the advancing wire alternately to such a partial deplating step followed by such a depositing step until the resultant copper layer possesses a thickness sufficient to provide a highly conductive composite wire.

Polishing Lubricant

U. S. Patent 2,687,357. *Aug.* 24, 1954. *E. A. Fiser*

A solid composition for application to cutting and abrading surfaces for preventing "loading" of such surfaces to increase the cutting and grinding action of such surfaces containing the following ingredients in approximately the proportions stated to provide a 100 pound lot:

Tallow	pounds	65
Paraffin	do	29
Beeswax	do	6
Citric acid	ounces	1.3
Oxalic acid	do	1.3
Potassium citrate	do	1.3
Urea	do	6.6

and Vienna Red in sufficient amount to produce the color desired.

Abrasive Blasting

U. S. Patent 2,686,991. *Aug.* 24, 1954. *G. W. Powell and C. E. Brunner, assignors to Pangborn Corp.*

A blast cleaning machine for cleaning the surfaces of cylindrical workpieces, said machine comprising a cabinet enclosing a work supporting structure having at least one roller positioned for supporting one of said workpieces by a portion of its cylindrical surface, drive elements connected fof rotating said roller about an axis parallel to the longitudinal axis of said surface for rotating said workpiece about its longitudinal axis, said drive elements also being connected for revolving the work supporting structure in a plane of revolution about an axis approximately perpendicular to said longitudinal axis simultaneously with said rotation, and abrasive projecting structure for projecting a stream of abrasive particles approximately in said plane of revolution for cleaning all surfaces of the workpiece.

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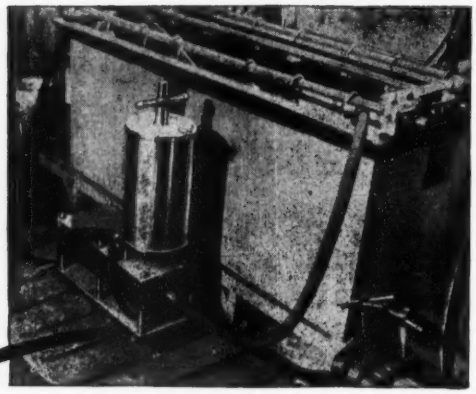

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ABSTRACTS

Excess Sulfuric Acid in Chromium Plating Bath

Metallwaren-Industrie und Galvanotechnik, vol. 45, No. II (November 1954), p. 558.

Discussing the question of excess sulfuric acid in the chromium plating bath and its removal, the sulfuric acid to be removed, ascertained on the basis of analysis, is frequently precipitated by the required amount of barium carbonate. The reaction, however, is not entirely a simple one of the direct formation of barium sulfate. It is necessary to consider the composition of a chromium plating bath as the course which the reaction takes follows directly from this composition. The relatively slow speed of the reaction and the relatively retarded appearance of the effect desired, when barium carbonate is added to the bath for removal of excess sulfuric acid, can also be ascribed to this. Chromic acid is actually chromic acid anhydride, which reacts with water according to the equation: $CrO_3 + H_2O = H_2CrO_4$. This is readily soluble in the water present and partly dissociates into hydrogen and chromate ions. As regards its acid effect, chromic acid is somewhat weaker than strong mineral acids such as sulfuric.

In a chromium plating bath, however, the chromic acid is present in considerably greater amount than the sulfuric acid (chromic acid: sulfuric acid ratio is about 100:1). Under these conditions, therefore, there is available a considerably greater amount of chromic acid for the formation of barium chromate:

(1) $BaCO_3 + H_2CrO_4 = BaCrO_4 + H_2O + CO_2$.

A small portion of the barium carbonate can also react directly with the sulfuric acid according to the equation:

(2) $BaCO_3 + H_2SO_4 = BaSO_4 + CO_2 + H_2O$.

The barium chromate which is formed according to equation (1) then reacts further with the sulfuric acid present to form chromic acid and barium sulfate:

(3) $BaCrO_4 + H_2SO_4 = BaSO_4 + H_2CrO_4$.

Reaction (3) proceeds somewhat slowly. As barium chromate and barium sulfate are not absolutely insoluble in the bath, the desired ultimate formation of barium sulfate proceeds relatively slowly because, with insufficient dispersion, the barium sulfate formed at the surface can completely seal off the barium chromate from further reaction. It is consequently necessary to form a slurry of the barium carbonate in water (in which it is insoluble) and then to add this to the chromium bath in small portions, with adequate stirring.

When the last portion of the calculated barium carbonate has been added to the bath, then adequate stirring should be continued for a number of hours. While this stirring is proceeding, the sulfuric acid content of the bath should be checked periodically by analysis and the course of the reaction thus followed. The analysis samples need to be first filtered. The desired reaction can be speeded up by heating up the bath to be corrected. The actual time taken to regenerate the bath will depend upon the excess of sulfuric acid, the mixing effect achieved, the form of the barium carbonate added (a finely divided form will act more quickly), and on the temperature. This time will range from a number of hours up to a full day according to circumstances. As barium sulfate is precipitated in a very finely divided form and only settles out very slowly, care has to be taken, accordingly, when the bath is put back into service unless the precipitate is removed by decantation or filtration,

whichever is preferable. Of some importance are the necessary characteristics of the barium carbonate used and its purity. It should be in a powder form, free from coarse lumps, and have a white color (not reddish-brown); it should completely dissolve in hydrochloric acid. If 2 grams of the barium carbonate are placed in a flask and about 5 cc. of HCl (1:1) added, a piece of lead acetate paper held over the top of the flask, should not blacken.

Barrel Nickel Plating of Steel Balls

O. Niedermeyer; *Metallwaren-Industrie und Galvanotechnik;* vol. 45, No. II, p. 559.

The practical case is considered in which steel balls are given a 2 micron nickel plate in a barrel plating unit. The required thickness of the deposit is calculated from the plating constants and means are indicated as to how this can be done in the present case. With all barrel plating electrolytes in no case can one calculate on the basis of normal current efficiency as with ordinary still tanks. Fairly precise investigations, which have been conducted by the author in this connection, have indicated that, in the barrel plating unit, and according to the electrolyte used, about 40-60% of the normal current efficiency figure can be achieved. It is calculated that 1 kg. of the steel balls being plated will have a surface area of about 33 sq. dm. With a current density of 2 amps./sq. dm. under still tank conditions, about 12 minutes is required to obtain coating thickness of 2 microns. As the practical current efficiency in the barrel plating unit under favorable conditions amounts to 50% the running time will thus be 24 minutes.

The charge weight of articles with which the barrel is loaded (i.e. the total specific surface loading of the barrel unit as governed by this) will depend practically upon to factors. The first obvious one is the loading capacity of the barrel and the second will be the output loading of the D. C. power supply. Thus, for a weight loading of 4 kg. in the barrel there will be required:

4 × 33 sq. dm. = 132 sq. dm. × 2 amp. = 264 amp. current.

If, instead of the normal electrolyte, a high loading output electrolyte is used for the barrel unit, which can be obtained from commercial suppliers, then by way of example it would be possible to operate the barrel with a current density of 4 amp. sq. dm. and the running time of the barrel unit could then be shortened to 12 minutes per charge. This is of further practical advantage because, when barrel plating, with too long a running time to obtain a required coating thickness one has to reckon on rubbing wear losses which, in cases, have been established up to 30%. The same remarks also hold good with equal force for loading the barrel unit with too small a charge.

Recent research in barrel plating of small balls have also served to confirm the fact that one can reckon on a maximum of 50% of the normal current efficiency in barrel plating as compared with a still tank.

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TECHNIC INC., 39 Snow Street, Providence, R. I.

Send us prepaid sample pound of Tech-Tin with instructions for rapid immersion plating. Check (or purchase order) for $2.00 is enclosed.

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THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

Metallizing of Non-Conducting Materials

Metallic Bull. (Holland); vol. 3, No. 8, pp. 197-200 (1954).

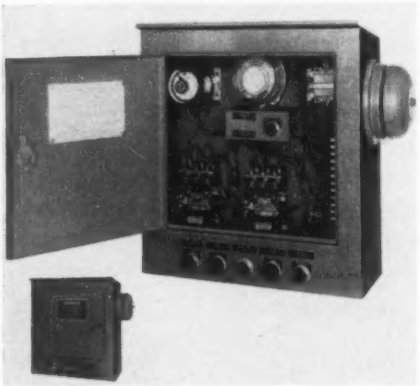
A critical survey is provided of the various methods which are available for providing metallic coatings on non-conducting materials: rubber, glass, plastics, wood, etc. In the main, such metallic coatings are used today as a preliminary conducting coat for a subsequent plating. The processes which are normal to present-day practice are: (1) The use of metal powders and graphite. (2) The deposition of metal coatings by chemical reduction. (3) The cathode sputtering method and (4) The vacuum vapor deposition processes are fairly completely surveyed.

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Chemical Feed Control Unit

Graver Water Conditioning Co., Dept. MF, 216 West 14th St., New York, N. Y.



A complete chemical feed control apparatus in one small, accessible, high-visibility package combines precise control with an accurate liquid level alarm. This new unit can be used to regulate flow in any situation in which it is necessary to feed liquid chemicals, as in direct boiler feed, many process purposes and other such applications, according to the manufacturer.

One of its chief features is a high degree of adjustability in timing arrangements. The total time cycle, that of the chemical fed, and the length of non-feeding time can be set so that they will proceed automatically until chemical supply is exhausted or a new setting is decided upon. In a typical arrangement, the total cycle might be one hour, the chemical might be pumped for fifteen minutes, another chemical or a water rinse for the same interval, and the shut-off period would be half an hour. Also, if necessary, only a single switch need be turned to produce a continuous flow of chemical, subject to manual control.

The liquid level alarm consists of an electric probe in the chemical tank, set at such a level as to give warning in ample time to allow the tank to be refilled before it empties completely. The warning bell begins to sound when the level in any tank falls below the probe and continues until the operator throws a switch. The bell is then silenced, but an alarm light remains lit until that tank is refilled. To identify the low tank, the operator simply sees which light is lit on the control box — one light corresponds to each tank. When the tank is filled, the light goes out and the bell sounds again, notifying the operator, who then resets the 'alarm silencing switch' to its original position. This silences the bell and resets the level alarm.

The case is splash-proof and dustproof. Its dimensions are approximately 24" wide by 30" high by 8" deep. All external wiring is brought to a single convenient terminal strip.

Sulfate Test Set

Kocour Company, Dept. MF, 4802 S. St. Louis Ave., Chicago 32, Ill.

The Kocour Sulfate Test Set is now available with either of two centrifuges, a compact hand driven centrifuge and the convenient electric centrifuge. This analytical set determines the sulfate content in a chromium plating solution. Additional procedures are available for determining sodium sulfate or Epsom salts in nickel plating solutions. Operation of this test set is very simple. It was designed so that anyone can make a test. No knowledge of chemistry is required.

Flatware Polisher

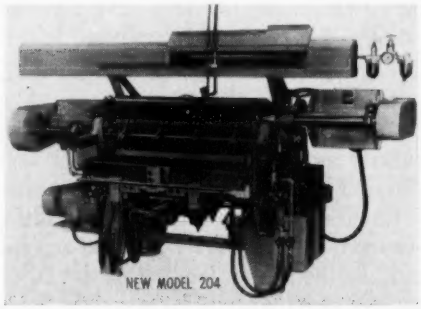
Clair Mfg. Co., Inc., Dept. MF, 1002 S. Union St., Olean, N. Y.

Capable of complete and simultaneous coverage over both inside and outside of spoon and fork bowls, the new model No. 204 Clair Surface Finishing Machine has revolutionized finishing practices throughout the tableware industry. The progressive evolution of the current spoon and fork polisher reflects the cooperation and assistance of many well known flatware manufacturers.

Although the latest version, Model 204, incorporates the same basic patented principles, and retains complete interchangeability of moving parts with its earliest predecessor, it is interesting to note the hundreds of progressive modifications and improvements since the earlier machines were first assembled.

From the legs up, every structural member has been re-engineered for greater strength. Originally limited to 5 H.P., this new machine is stressed for as high as 15 H.P. spindle motors. Based upon years of service experience, all long range vulnerable wear points now incorporate replaceable hardened wear inserts; as today's machines take full advantage of vastly improved hydraulic, air and electrical components. Versatility has been increased by virtue of additional and more flexible adjustments.

Particularly noteworthy among the achievements are the transitions to V-belt spindle drives; automatic air float



of rolls at any predetermined uniform contact pressure; 110 volt control circuits; auto-cycling; sealed cartridge type ball bearings; high surface speeds; body-pressure safety-bar control and automatic spray application of compounds.

Also worthy of mention are such added features as adjustable automatic

H-VW-M Sisal Buffs

BIAS SISALWEEV

FULL DISC SISALWEEV

BINDERIZED SISALWEEV

SISALIN SECTIONS

HANSON-VAN WINKLE-MUNNING COMPANY

MATAWAN, NEW JERSEY

Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies

Plants: **Matawan, New Jersey • Grand Rapids, Michigan**

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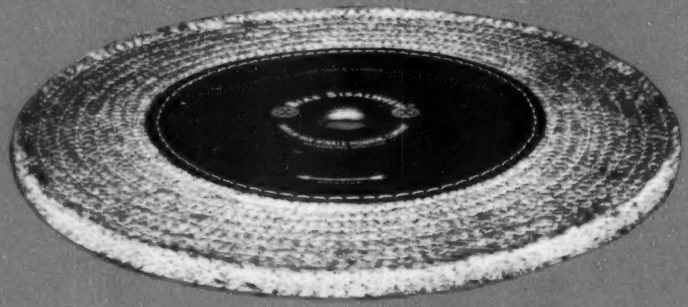
the complete line of

bias sisalweev, full disc sisalweev, binderized sisalweev, sisalin sections

Produced from top grade sisal fibre, H-VW-M Sisalweev Sections represent a step forward in cutting and polishing wheel efficiency for severe operations on drawn, stamped, or cast ferrous and non-ferrous metals.

With a broad range of adaptability to many polishing and buffing room operations, they are responsible for increased production and substantial savings in time and operating costs. Oil-impregnated sisal cloth, tightly woven and heavily compressed in the manufacturing process, is the supple and sturdy backbone of all sisalweev sections. Two styles are available—bias cut and full disc.



Bias Sisalweev Section with fibre-board center.

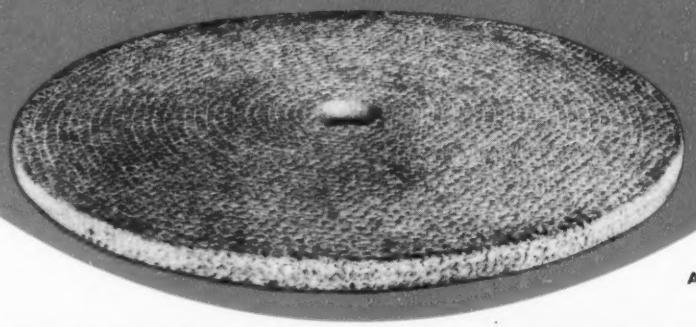
BIAS SISALWEEV* SECTIONS

An improved product, these sections have a longer life and provide more even finishes as a result of their special construction. The sisal cloth used in their makeup is cut *on the bias* and sisal fibres emerge at the contact edge of the buff at approximately a 45° angle. The other end of each strand is anchored deep in the hub of the section. Wearing evenly, this design outlasts any other for heavy-duty cutting.

Each section has its own sturdy fibre-board center —no special hubs or flanges are required. Sections are approximately ⅜" thick, made from 8 plies of sisal fabric. Outside diameter sizes are 12", 14", 16", and 18", with sewing spacings of ⅛", ¼", and ⅜".

Centers are available 5" or 7" in diameter.

The sewing process is of primary importance in developing this long-wearing product. Extra-heavy thread is used and sections are sewed under great tension. The outside row of stitching is made close to the periphery to inhibit fibre separation.



A Full Disc Sisalweev Section showing the solid sisal construction.

FULL DISC SISALWEEV SECTIONS

Presenting a mass of strong, abrasive, and tough fibre ends, the contact surface of Full Disc Sisalweev provides an excellent cutting medium where difficult buffing conditions are involved. The thread stitching, which functions as a binding agent for the layers of fibre, is sewed spirally from the very edge of the arbor hole to within approximately ⅛" of the periphery. A latex treatment can be provided which anchors individual fibres, extending service life.

Full Disc Sisalweev Sections are made in all diameters from 6" to 24". Standard thickness is ⅜". Sewing spacings range from ⅛" to ½".

H-VW-M Bias and Full Disc Sisalweev sections are designed to be used with H-VW-M compounds for best results. Detailed information regarding the best type of compound for specific operations will be supplied on request, or ask for Bulletin Co-102.

*U. S. Pat. No. 2,642,706

Sisal Buffs

BINDERIZED**
SISALWEEV SECTIONS

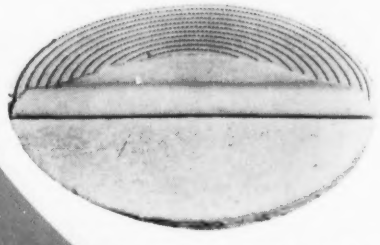
Binderizing is the unique H-VW-M impregnation applied to various buffing tools, increasing their service value by an average of 30%. The entire buff section is thoroughly impregnated with the same binder materials used in buffing compounds.

Applied to either Bias or Full Disc Sisalweev Sections, Binderizing produces a number of outstanding results in addition to increasing their durability. Through this new H-VW-M process, the relatively low affinity of sisal fibre to compound has been greatly increased, improving composition adherence and saving on excessive re-applications of compound during use. "Breaking in" time is eliminated. The strength and suppleness of the fabric is improved with this internal lubrication and the operation is cooler and the cutting deeper.

Binderized Bias and Full Disc Sisalweev Sections can be used in every application for which untreated sisal buffs have been designated, and with all of the advantages and savings which have been outlined. In addition, more severe cutting jobs can be undertaken because of the nature of the improved product. The range of adaptability of Binderized sisal buffs is therefore much broader, emphasizing their long-term economy.

**Patent pending

SISALIN SECTIONS***
the combination of buffing and polishing wheel



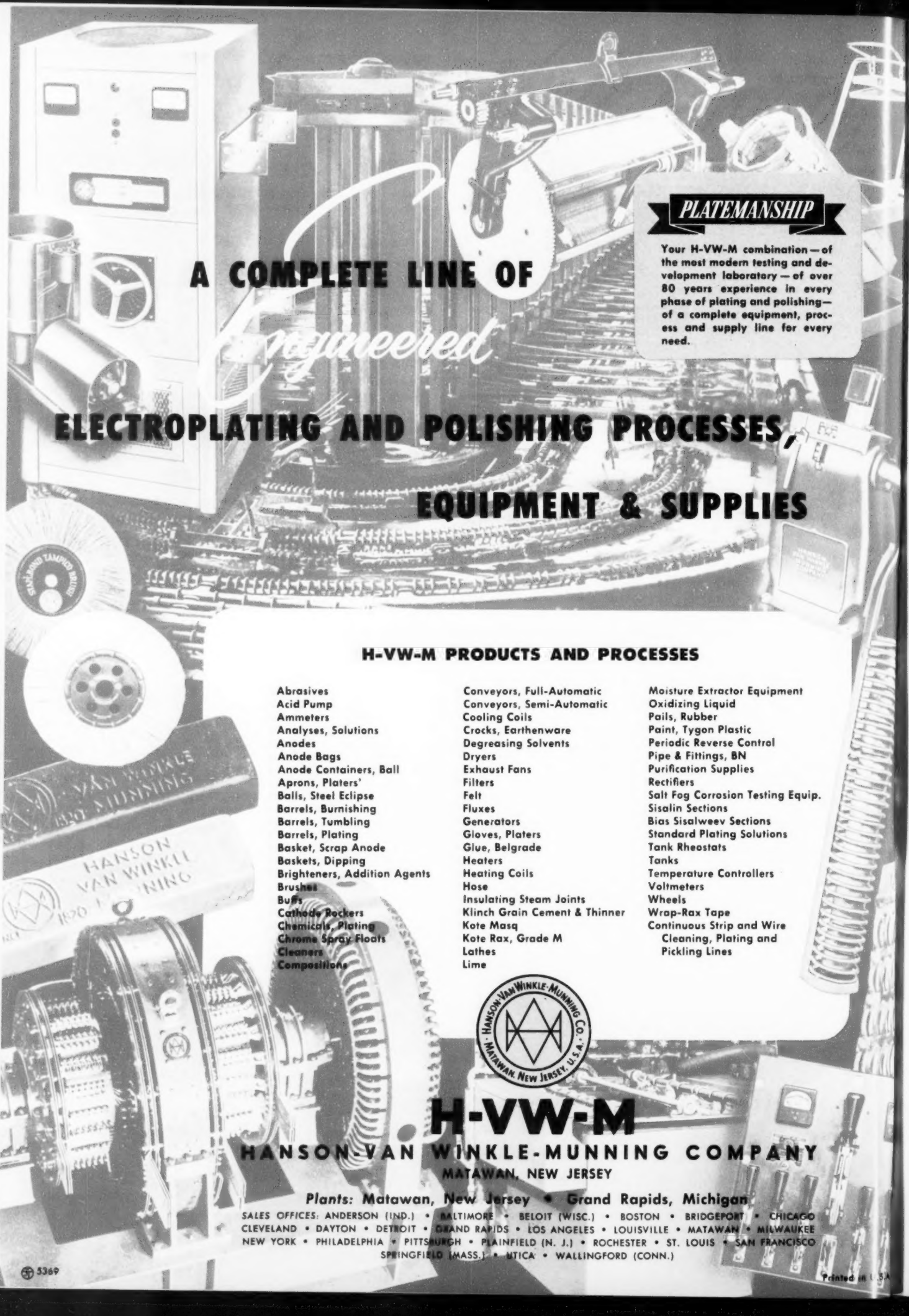
Sisalin Section showing muslin ply and matted sisal ply, alternated.

Used in finishing articles made from drawn, stamped, or cast ferrous and non-ferrous metals. Particularly well suited for buffing steel surfaces before nickel and chrome plating, and equally efficient at high or low speeds. A special treatment, #30, can be added for improved stiffness and cutting property. Available diameters range from 6" to 24" with 1/8"; 1/4", 3/8" or 1/2" sewing. Sections are 3/8" thick.

***U. S. Pat. No. 2,108,985

When ordering Sisalweev or Sisalin Sections, specify:

1. Outside Diameter
2. Thickness
3. Arbor Hole
4. Spiral Sewing (1/8", 1/4", 3/8", 1/2")
5. Diameter of Fibre-board Center (Bias Sisalweev only)



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Aprons, Platers'
Balls, Steel Eclipse
Barrels, Burnishing
Barrels, Tumbling
Barrels, Plating
Basket, Scrap Anode
Baskets, Dipping
Brighteners, Addition Agents
Brushes
Buffs
Cathode Rockers
Chemicals, Plating
Chrome Spray Floats
Cleaners
Compositions
Conveyors, Full-Automatic
Conveyors, Semi-Automatic
Cooling Coils
Crocks, Earthenware
Degreasing Solvents
Dryers
Exhaust Fans
Filters
Felt
Fluxes
Generators
Gloves, Platers
Glue, Belgrade
Heaters
Heating Coils
Hose
Insulating Steam Joints
Klinch Grain Cement & Thinner
Kote Masq
Kote Rax, Grade M
Lathes
Lime
Moisture Extractor Equipment
Oxidizing Liquid
Pails, Rubber
Paint, Tygon Plastic
Periodic Reverse Control
Pipe & Fittings, BN
Purification Supplies
Rectifiers
Salt Fog Corrosion Testing Equip.
Sisalin Sections
Bias Sisalweev Sections
Standard Plating Solutions
Tank Rheostats
Tanks
Temperature Controllers
Voltmeters
Wheels
Wrap-Rax Tape
Continuous Strip and Wire Cleaning, Plating and Pickling Lines

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dwell control to emphasize any localized coverage of work; hand crank adjustments for magnitude and centering of side oscillation; adjustable flow control valves in all directional leads of hydraulic and air circuits; and a complete line of holding fixtures and transfer jigs for spoons and forks.

Resin Protective Coating

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Bldg., Philadelphia 7, Pa.

Maintenance engineers long in search of better protection for surfaces exposed to humid and corrosive atmosphere are now reporting excellent results from the new resin coating product Thick-Coat, according to the company.

Used with special Pennsalt high bond strength primers to ensure adhesion, the system provides a durable protective coating for new or corroded metal, concrete and wood equipment and structures or surfaces exposed to fumes, corrosive chemical laden atmospheres or spillage of corrosive chemicals of acid, alkaline or neutral nature.

The coating has excellent flow qualities and is applied like regular maintenance paint by brush, roller or spray as it comes from the can. In a three coat system — 1 primer and 2 top coats — it will build to a minimum of 6 mils dry film thickness. Containing over 60% solids by weight, the coating assures long lasting protection on edges, prominences and crevices as well as on plain surfaces.

It is regularly offered in white, green, slate gray and black. Other colors are available on special order.

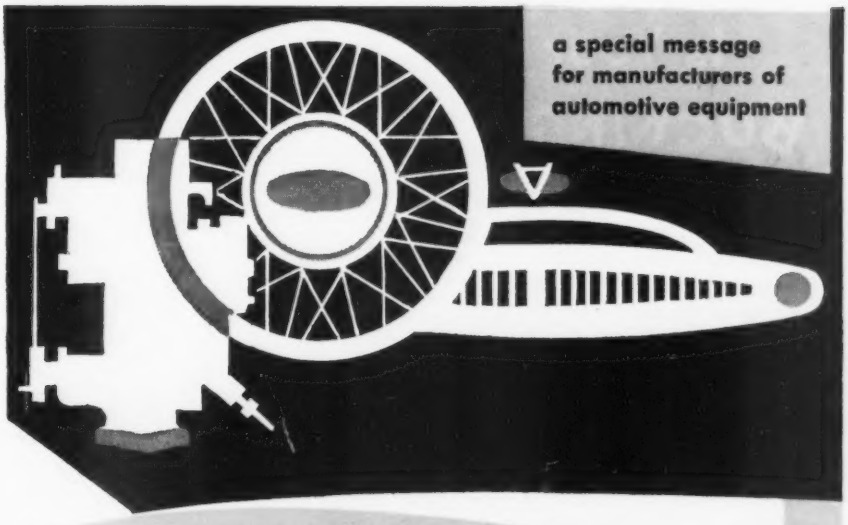
Phosphate Coating Material

Klem Chemicals, Inc., Dept. MF, 14401 Lanson Ave., Dearborn, Mich.

A new addition to the company's line of phosphatizing materials called Klem Kote #1105, contains improved accelerators which give exceptionally good cleaning to the metal, especially where carbon smut is a problem, according to company claims.

The material is a moist white powder used on both ferrous or non-ferrous metals that produces a tight iron-manganese type coating. It can be used in either spray type or immersion cleaning equipment.

Because of its high cleaning properties, the product is stated to be extremely efficient in a 3-stage spray operation.



need a finish for low cost corrosion protection or showroom sparkle?

specify IRIDITE®

Whether you're finishing non-ferrous parts for high corrosion protection, paint base, or for showroom sales appeal, you can be sure of low material and production costs and peak performance when you specify Iridite. Here's what you can do with Iridite:

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

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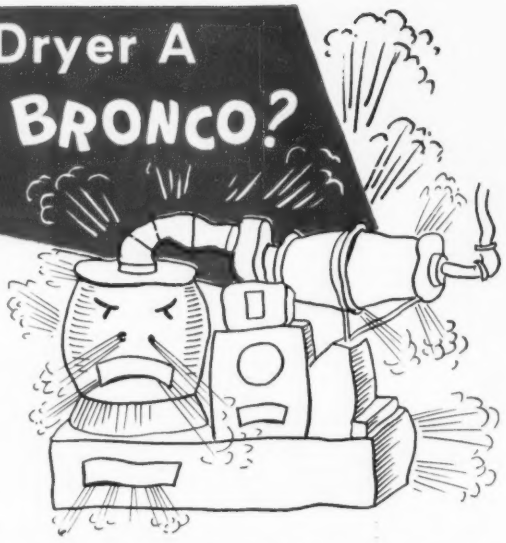
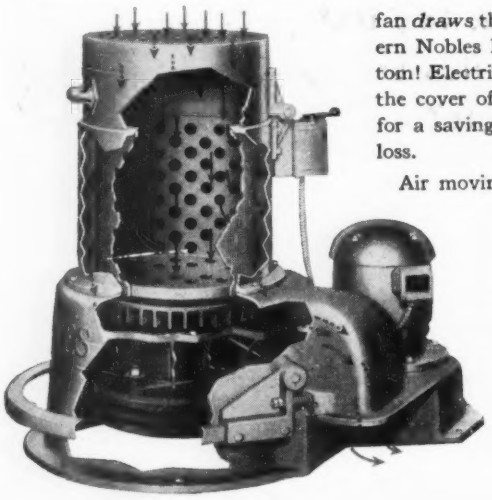
Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
WEST COAST LICENSEE: L. H. Butcher Co.

Is Your Dryer A BUCKING BRONCO?



In order for a centrifugal dryer to stay put it should be heavy. That's why the modern Nobles Dryer is about twice the weight of most dryers. Extra weight is one of the reasons for its stability, its freedom from vibration, its smooth operation, and long trouble-free life.

It's all new in design and principle. A powerful suction fan *draws* the air completely through this modern Nobles Dryer and exhausts it at the bottom! Electric or steam heaters are mounted in the cover of this machine of advanced design for a saving of space and elimination of heat loss.



Air moving equipment isn't an extra. The powerful suction fan is an integral design feature of each machine. A brake pedal extending around the entire work area controls an internal, expanding hydraulic brake for quick, smooth stops.

Why not take the first step now toward modern quick drying and lowest costs?

NOBLES ENGINEERING & MANUFACTURING CO.

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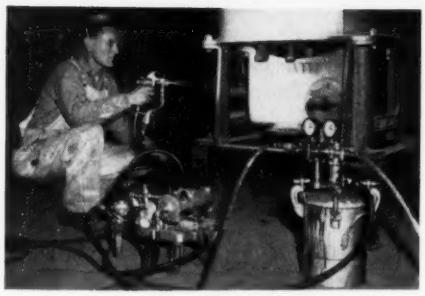
Write Today for the FREE NOBLES DRYER BROCHURE



Highly Stabilized Safety Solvent

Tect, Inc., Dept. MF, Cortland Ave. and Erie St., Dumont, N. J.

A new, highly stabilized Vythene safety solvent only 1/20th as toxic as carbon tetrachloride is now available.

The solvent is a stabilized 1, 1, 1-trichloroethane on which a U. S. patent is pending. It can be refluxed indefinitely in the presence of such reactive metals as aluminum, brass and copper without any chemical breakdown such as has been experienced with uninhibited or only partly inhibited brands of 1, 1, 1-trichloroethane according to the manufacturer. It is non-corrosive to all metals and practically inert to ordinary electrical insulating varnishes and materials.

Hot Spray Vinyl Paint

The U. S. Stoneware Co., Dept. MF, Akron 9, Ohio.

A new hot-spray-applied vinyl-based protective coating builds a film thickness in two coats equal to five coats of cold spray vinyl coatings, according to the manufacturer.

The new coating, Tygon ATD, combines vinyl and other plastic resins to form a high solids content viscous material that reverts to a liquid form on the application of heat, thus avoiding the use of excessive amounts of solvents to achieve spraying consistency.

The paint is brought to a temperature of approximately 160°F. in a standard paint heater. An air pressure of 20 lbs. forces the heated paint to the spray gun where it is atomized by 50 lbs. of air. As the hot paint leaves the spray gun most of the incorporated solvents are evaporated and a thick, high solids content film is deposited on the target. Since but little solvent remains in the film, drying is remarkably quick.

The dry film is extremely dense and impermeable. Spark testing shows a complete absence of pin holes and field tests indicate that labor costs are cut as much as 20%, it is claimed.

Material saving is substantial since no thinners are required. Overspray is reduced and "drifting" of wet spray is virtually eliminated.

The hot spray paint is resistant to the attack of most commercially used acids and alkalies, as well as to alcohols, water and oils. It is, however, attacked by aromatic hydrocarbons, ketones and esters.

Plastic Fabrications

H. N. Hartwell & Son, Inc., Dept. MF, Park Square Bldg., Boston, Mass.

The above manufacturer announces the addition of all-molded, seamless valves to their line of pipe, fittings, rods, blocks, sheets and special fabrications sold under the Boltaron 6,200 trade name.

The new valves and standard threaded I.P.S. fittings in sizes ¼" to 2" are resistant to most industrial chemicals. Already in extensive use in a large number of diverse industries, the material is unaffected by strong or weak organic or inorganic acids, alcohol and alkalies. In pipe form it has high flow characteristics and will not rust or scale. Its weight is about half that of aluminum. It is highly workable and may be threaded and handled like ordinary pipe.

The company trains and licenses fabricators throughout the United States and in Canada who assist in and direct many custom fabrications such as tanks and tank liners, duct systems and exhaust and ventilating systems.

Protective Coatings

Carboline Co., Dept. MF, 331 Thornton Ave., St. Louis 19, Mo.

Neoprene W is a new economical, one component neoprene synthetic coating which is easily applied by brush or spray. Curing takes place at room temperature. It is recommended for maximum maintenance protection against most acid and alkali fumes and splash and high humidity, and shows excellent resistance to abrasion and weathering.

Advantages are claimed to lie in its simplicity of application. No catalysts or accelerators are required — only wirebrushing of metal surfaces to remove dirt, rust and scale is necessary. This is followed with one coat Neoprene W primer and two coats of Neoprene W for a final thickness of 8 mils, on either flat or vertical surfaces. Drying time between coats is about 2-3 hours and in most cases the coated surface can be placed in service after 24 hours. Coverage is 420 mil feet per gallon (140 sq. ft.—3 mil film).

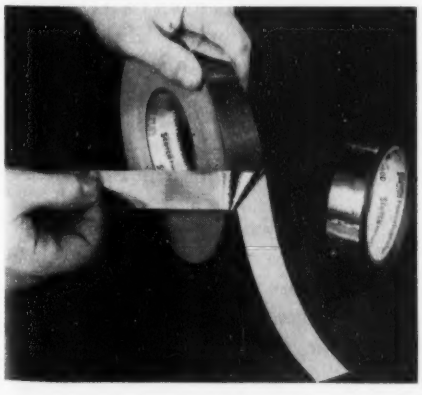
Pressure-Sensitive Tape

Minnesota Mining and Manufacturing Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

Two new pressure-sensitive film tapes, each possessing unusual strength although only 2-mils thick, were announced last month for widespread industrial use.

The tapes, "Scotch" brand polyester film tapes Nos. 850 and 852, have similar physical characteristics and metallic (silver) appearances. Each has a polyester film backing that is described as being superior to most existing plastics in heat and chemical resistance.

Their polished-silver appearance, 3M explained, is achieved by vapor-depositing aluminum between the tapes' adhesive and backing. The tapes differ only in that the No. 852 tape is printable and is supplied with a special polyethylene-coated paper liner.



Both tapes possess excellent resistance to acids, alkalies, ketones, hydro-carbons, esters, and other common solvents, as well as excellent resistance to all sorts of weather conditions, according to the manufacturer.

Because neither tape will crack, chip, or peel, they are expected to find widespread use by toy, home appliance, sporting equipment, power tool, and various other manufacturers for marking, labeling, and decorating their products.

The two new tapes are being made available in ¼- to 23-inch width on 72-yard rolls from paper and industrial supply houses nationally. Wider widths and longer roll sizes will be made on special order, 3M explained.

Sample ¾-inch by 3-yard rolls are available on request from the company.

Sheet Cleaning Machine

Fuller Brush Co., Machine Division, Dept. MF, Hartford 2, Conn.

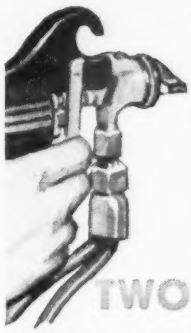
A new industrial scrubbing machine that cleans both sides of metal sheets from all traces of surface dirt and oils has been developed by the above company.

The sheet scrubbing machine cleans plates to the high degree necessary to pass successfully the water break test for cleanliness. That is, a film of water spread on the surface will be continuous when the plate is clean. The

TYGON "ATD"

Hot Spray

PAINT



TWO COATS DO THE WORK OF FIVE

Here's the *real* corrosion-protection you've been looking for — for tank exteriors, fume hoods, ducts — everywhere corrosive fumes play havoc with plating room equipment.

With two coats of TYGON "ATD" HOT SPRAY PAINT you get more protection than from five coats of conventional cold spray or brush coatings.

Thickness is the answer. Hot Spray Tygon "ATD" builds 3 mils or more thickness in a single coat. Five to six mils in two passes of the spray gun.

What's it mean to you? Better protection! Longer-lasting protection! And a dollar and cents saving of up to 30% or more in corrosion protection costs.

A ADHESION

T THICKNESS

D DENSITY

GET THE FULL STORY TODAY!

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PLASTICS AND SYNTHETICS DIVISION

THE U. S. STONEWARE CO.

AKRON 9, OHIO

63E-1

CrO_3

In deciding upon the brand of Chromic Acid to use, successful platers consider three factors:

1 — *Purity of the product as indicated by the assay and maximum limits of impurities.*

2 — *Experience and technical competence of the producer.*

3 — *Reliability of the manufacturer as demonstrated during periods of shortage.*

More Mutual Chromic Acid is used than any other brand because the metal finishing industry has found Mutual's record to be outstanding on all three counts.

CHROMIC ACID · SODIUM BICHROMATE
POTASSIUM BICHROMATE

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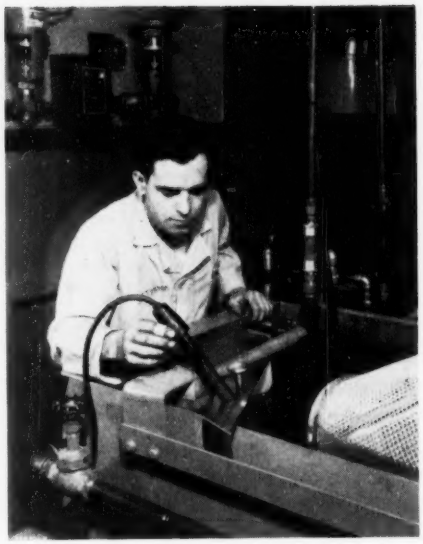
Mutual Chromium Chemicals

99 PARK AVENUE · NEW YORK 16, N. Y.



claimed to result from the installation of the Solu Bridge automatic rinse tank controller.

The basic instrument used in this system has had a long history of successful applications in many fields. Its adaptation to the plating industry makes available, for the first time, the possibility of completely eliminating guesswork regarding dragout between tanks in the plating line.

Water savings such an installation can effect are frequently more than 50%. In an Eastern gold-plating plant, for example, the water bill has been reduced by a rate exceeding $10,000. per year. Furthermore, because of serious water shortages in many areas, and the growing influence of Federal Law No. 845 (which makes stream pollution a Federal responsibility) there is sharply increasing interest by platers in the batch treatment of collected rinse waters. The new instrument, by allowing far less water to be used for rinsing, is stated to help considerably in making such batch treatment economical and practical.

The rinse tank controller operates by continuous measurement of the degree of electrolytic conductivity of rinsing waters. Automatic control of the amount of fresh water admitted into rinse tanks is thus permanently established by this simple, inexpensive and thoroughly reliable system.

water film breaks where any surface oil remains.

There are two models, a long and a short. The longer machine removes heavier accumulations of surface dirt. Either machine processes sheets at the rate of 60 feet a minute. A detergent and water solution is pumped onto the plates when they enter the machine. They are then scrubbed with nylon cylindrical brushes, and rinsed and dried as they come out.

Automatic Rinse Water Control

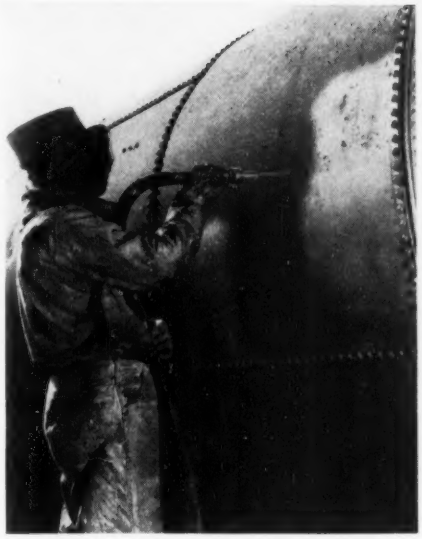
Industrial Instruments, Inc., Dept. MF, 89 Commerce Road, Cedar Grove, N. J.

Greatly reduced water consumption with increased plating quality is

Dustless Blasting Shot

Baldwin-Hill Co., Dept. MF, Trenton, N. J.

A new non-metallic, dustless blast-cleaning agent is said to permit substantial savings in production time, material cost, and blasting-equipment



Mono-Klean mineral shot is being used to blast-clean rust and scale off a large tank.

maintenance, as compared to sand and metallic shot. Called Mono-Kleen, the spherical mineral shot blast cleans uniformly in one pass with no dust clouding the operator's vision and leaving the surface free of grime, film and dust.

It is claimed that blast-cleaning time can be reduced as much as 50 per cent with one-third less material, as compared to sand. The spherical characteristic of mineral shot reduces wear on the mixing chambers, hoses, and nozzles of the blasting-equipment. In addition, because mineral shot flows more freely and requires a lower impact velocity (having a greater density than sand), lower blasting pressures and therefore reduced power costs are obtained.

The mineral shot can be reclaimed and reprocessed for use again. Its original cost is only slightly higher than sand and is appreciably less than metallic shot.

The new shot contains only 0.1 per cent free silica by X-ray diffraction tests and therefore constitutes no health hazard. It is chemically inert in the presence of moisture and will not discolor metallic or non-metallic surfaces. Since mineral shot does not absorb moisture, it can be left in blast-cleaning equipment with no danger of corrosion and will not clog in lines and mixing chambers.

The shot comes in two types: Type "S" for heavy duty use in foundries, metalworking shops, and general blast cleaning and Type "F" for exceptionally fine finish on precision metal parts, glass, wood and other materials. Both types are shipped in bulk or in 100-lb. valve-type, multi-wall paper bags. The bags are 420-lb. test and are suitable for limited outside storage.

FOR LASTING
BRILLIANCE
ON ZINC....
B 4 • B 4M
.....and C-42
Want hard striking, durable, fine grained zinc deposits that will withstand tough handling, storage and service? Experience in operating more than a quarter million gallons of cyanide zinc solution throughout the free world is at your call . . . when you call PROMAT.
Promat B 4 or B 4M brighteners are effective, economical addition agents for bright "out of bath" requirements on barrel, still, semi and full automatic work.
C-42 addition agent permits uniform coverage on parts having a wide range of cathode current densities . . . up to 200 amps per square foot—without burning. Produces a fine grained product, perfect for secondary coatings, such as the Proseals, and bright "out of bath" work, when used with B 4 and B 4M.
The Proseals are durable, easily applied chromate coatings for extended life under adverse service. In bright, bronze or olive drab.
Remember too . . . the complete line of Promat products for metal preparation and plating finishes are backed by responsible on-the-spot service and are the result of years of field and laboratory research, dedicated to serviceable products . . . for an enlightened industry. Write for bulletin 29M today:
PROMAT Division
Poor & Company
851 S. Market Street
Waukegan, Illinois

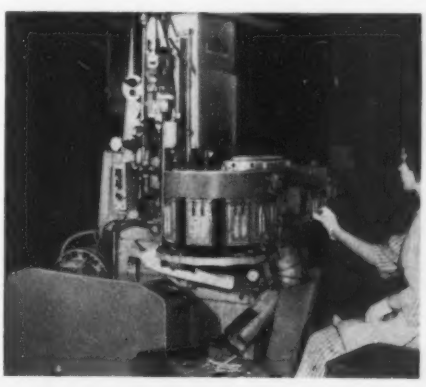
Belt Grinder

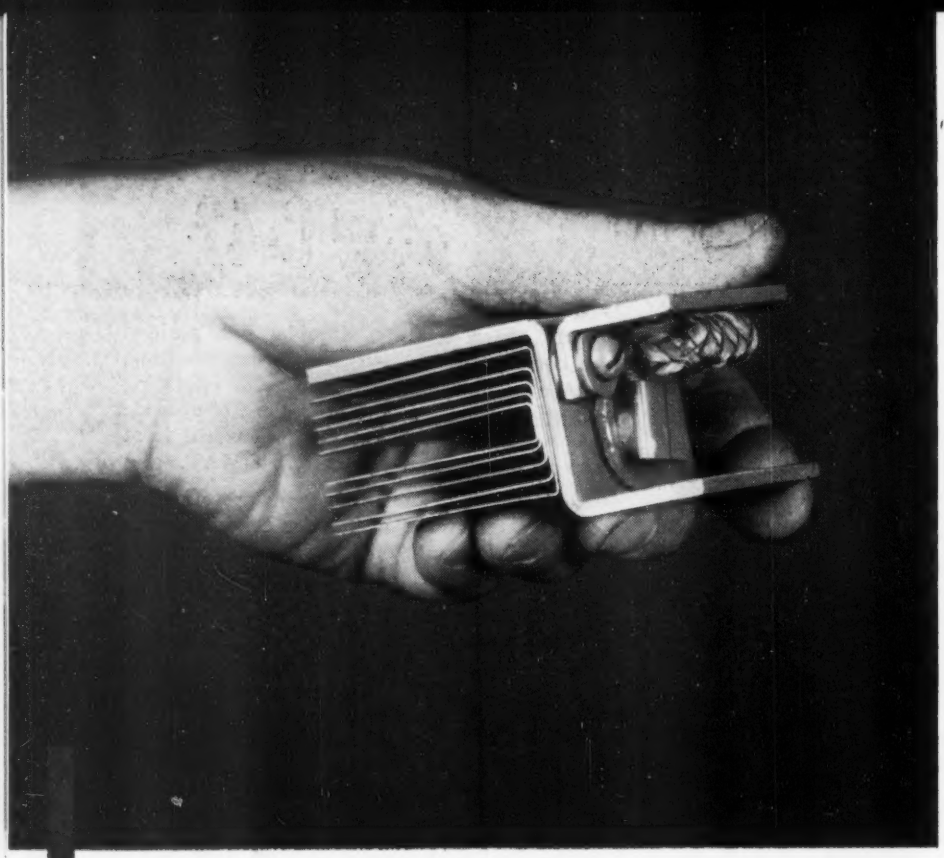
Engelberg Huller Co., Dept. MF, Syracuse, N. Y.

A new abrasive belt grinder, the BG-8 Automat, flat-grinds and polishes small metal parts rapidly and accurately. The new belt grinder is equipped with a self-powered, continuous work feed and an 8 x 107" abrasive belt. Work pieces for the new unit are manually loaded but automatically ejected.

The feed unit has 21 fixture plates, each 3¾" x 6¼". The number of parts that can be loaded on each fixture plate is limited only by their size. As the work advances to the belt surface, it is fed slowly across the belt, then is retracted quickly before reaching the far edge of the belt.

Feed speeds are variable; fixture plate rates of travel can be set at 1090, 1350 or 1750 per hour. Depending upon the number of work pieces on





GERMANIUM RECTIFIERS PERFORM WITH TOP EFFICIENCY

Udylite Tests Reveal Amazing Current Conversion Efficiency

This air cooled germanium cell with a rectifying surface the size of a dime will handle a 250 ampere load in a three phase circuit continuously and three years of tests show no detectable power losses. Including heat-radiating fins, it takes up just 8 cubic inches of space and weighs only 12 ounces.

Udylite in cooperation with the General Electric Company, now proudly introduces its new group of germanium rectifiers. Years of research and testing have proven that no other metal known offers the high efficiency of germanium as a rectifier material.

In operations calling for medium to high voltages, such as barrel plating, anodizing or chrome plating the efficiency of germanium soon pays the cost since the efficiency of a 3-phase germanium cell is *98* to *99 percent.*

Even at high loading germanium has less than one-volt drop in the forward direction. As for reverse current, germanium is again particularly good, having a reverse-to-forward resistance ratio of 400,000 to 1. Furthermore, Udylite germanium rectifiers require little maintenance and can be located in areas of minimum ventilation.

For further information regarding germanium rectifiers—prices, deliveries and specifications—consult your Udylite representative or write today direct to:

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

each plate, production rates up to 14,000 or more pieces per hour are possible.

The machine is 72″ high, 48″ wide and 48″ deep. Its coolant system consists of a 40-gallon tank in the base of the unit, divided into two sediment zones, with a cleanout at one side. Inside the belt housing, a fan-shaped jet sprays the belt. Coolant is also delivered to a spray nozzle above the work area.

Other standard equipment includes a hardened steel platen, 9″ wide x 12″ high, 7½″ H.P. drive unit with belt guard and motor platform, as well as starter, wiring, V-belts and pulleys. In addition to extra platens, accessory equipment includes an air belt tension control to maintain proper belt tension during grinding.

Polyethylene Bottles and Jars

American Agile Corp., Dept. MF, 5461 Dunham Road, Maple Heights, Ohio.

Polyethylene bottles and storage jars, featuring heavy-wall, all-welded construction, and designed for handling acids and other corrosive liquids, are now available from the above manufacturer. These bottles are especially important for applications where the elimination of permeability in handling inorganics is a factor, and this problem is minimized with these containers.

Both bottles and jars are fabricated from molded and cast sections and are welded by the hot gas welding process. They are of rigid construction and are leak-proof, and their light weight and resistance to impact and corrosive chemicals make them ideal for a large number of diversified industries.

Bottles are provided with a tight-closing screw cap. Jars are provided with a tight friction-fitting, easily-removable lid and are designed for storing and transporting liquid and solid corrosive substances that are moisture-sensitive or otherwise easily contaminated.

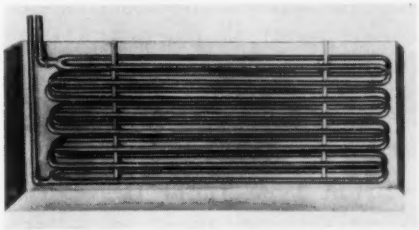
Ten standard sizes are available with

capacities ranging from one quart to five gallons. Special sizes may likewise be ordered.

Solution Heaters

Rempe Co., Dept. MF, 340 N. Sacramento Blvd., Chicago 12, Ill.

The above company has announced a new standard line called Hi-Therm



grid heaters for maximum, high speed, efficient heating of solutions in plating tanks, rinse tanks, cleaning tanks, caustic tanks and for all general fluid heating service.

These heaters feature a maximum amount of prime heat transfer surface in a limited space. The cross sectional width is only 2¾". The staggered arrangement of the tubes accelerates fluid motion by its high conduction and convection factor, a most important requirement in solution heating.

It is claimed that in practically all cases where solutions are to be heated to boiling, the installation of one heater on the back wall of the tank is all that is necessary. It can, however, be used on side or bottom of tank with horizontal or vertical supply and return.

Standard height 31½". Length to requirement. Fabricated from full weight bending quality wrought steel pipe and tested 350 lbs. pressure.

Average heat transfer coefficient for the standard grid when heating solutions of water to boiling point is 800 BTU per degree TD, per hour, per lineal foot of length OA.

For special applications in chemical and processing industries can be made of stainless steel, copper, aluminum, nickel, brass or any ferrous or nonferrous metal.

Phosphate Conversion Coating

Man-Gill Chemical Co., Dept. MF, 2338 Canal Road, Cleveland, O.

A new rust-inhibiting phosphate coating which is stated to improve appearances and durability of painted finishes is known as MG-601 and was developed to produce a rust-inhibiting phosphate coating in excess of 150 milligrams per square foot. According to the manufacturer, salt spray

THE UDYLITE BRIGHT NICKEL PROCESSES

The Result of 20 Years of Research and Consistent Improvement

Exceptional brightness and leveling, with great operational stability and simplicity of control characterize the Udylite Bright Nickel Processes.

Produced by Udylite Research, these patented processes have for years been accepted the world over as the standards for quality plating. All Udylite processes are constantly being improved by the Udylite Research Corporation with its fine facilities and outstanding staff. These three Udylite Bright Nickel processes are most generally in use today.

No. 31 is a high speed process with highly stable brighteners and wetting agent. It is economical to use and exceptionally trouble-free in yielding the most ductile and lowest stressed bright nickel deposits.

No. 31H process is the same as No. 31 except it operates in the high chloride type bath to permit even higher speed plating. It is exceptionally tolerant to zinc and iron impurities.

No. 41 process is used where high leveling and brilliance must be obtained with minimum thickness of nickel. This process has the widest bright plating range of any bright nickel bath down to the very low current density of deeply recessed parts. An exceptional bath for the plating of zinc die-castings.

Udylite welcomes comparison of its processes to all others. Send us a sample of the part to be plated and let us make recommendations. Write to:

WORLD'S LARGEST PLATING SUPPLIER

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

TO HELP SOLVE YOUR PRECIOUS METAL PLATING PROBLEMS . . .

For efficient, trouble-free plating results, *consistently*, you can safely depend upon APW anodes and precious metal salts for your plating production.

You'll appreciate APW service, too—deliveries are prompt, the valuable experience and facilities of our Electroplating Research Division are available to you—to help minimize your costs or improve efficiency in your plating procedures.

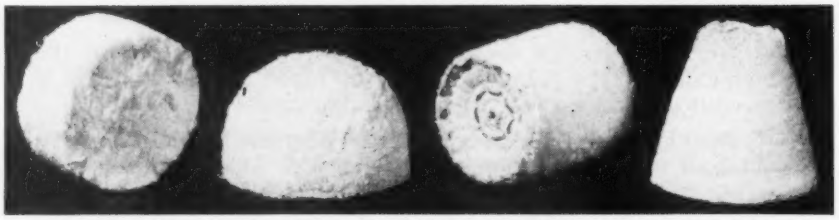
There's no charge or obligation for APW technical service. We want to be sure you know it's yours for the asking—that you use it *freely!*

A partial list of APW plating products:
A. A. SILVER ANODES
POTASSIUM SILVER CYANIDE
SILVER CYANIDE
C. P. SILVER NITRATE
Meets A.C.S. Specifications
Write for information and current quotations

THE AMERICAN PLATINUM WORKS
231 New Jersey Railroad Avenue • Newark 5, N.J.

APW

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

Your request on your letterhead will bring our complete catalog by return mail.

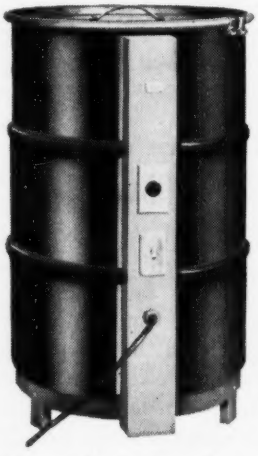
BARKER BROTHERS INC.
ESTABLISHED 1911
1660 Summerfield Street Brooklyn 27, N. Y.
Canadian Distributor — LEA PRODUCTS COMPANY, Montreal

tests with new product prove an increased life of painted finishes of from three to five times over the same painted metal untreated. As a paint base the fine grained crystalline structure provides the paint film with improved adhesion in addition to increased resistance to humidity and salt spray.

Easily applied to metal by immersion, the manufacturer states the new coating meets all government specifications and has a wide application wherever appearance and durability of painted finish is important to manufacturer and consumer.

Drum Type Vapor Degreaser

Armstrong & White, Dept. MF, Cheswick, Pa.



The Aircon basic barrel vapor degreasers, are of two types: The straight vapor degreaser and the heavy duty spray dgreaser.

In the straight vapor unit, parts are suspended in the drum and subjected to vapors of boiling trichlorethylene. Some types of oil and grease are more difficult to remove than others and require more than the straight vapor method of cleaning. This problem is solved with the heavy duty vapor spray degreaser, which incorporates a spray outfit to the basic degreaser. By spraying the parts with warm filtered solvent and then rinsing them in the solvent vapors, the difficult greases are easily removed.

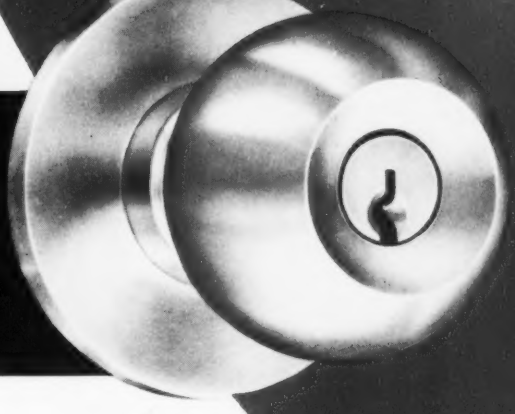
These degreasers are claimed to differ from any other barrel-type units in that they have a layer of insulation surrounding both the outside and underside of the barrel. Heat is retained and distributed better. Due to this outside insulation, operating costs are reduced.

Both models are electrically operated on either 110/115 or 220/230 v. AC. A plug-in receptable allows for the

LEA

ATTRACTIVE
MODERN
DURABLE
ECONOMICAL

Satin Finish for



SCHLAGE NOVO
Satin Finished Wrought Bronze using Lea Compound B31.

SCHLAGE SATURN
Satin Finished Aluminum using Lea Compound B31.

SCHLAGE®
LUSTER-SEALED ALUMINUM LOCKS

Here's a beautiful line of modern locks . . . LEA SATIN FINISHED for consumer eye appeal. It's a finish that's economical to produce. It's a finish that's extremely durable in hard use. It's a finish that's modern. It may be just the finish for your product.

The LEA GROUP
serving the Finishing Field
The Lea Mfg. Co., Waterbury, Conn.
Lea-Michigan, Inc., Detroit
Lea-Ronal, Inc., Long Island City, N. Y.
Lea Mfg. Co., of Canada, Toronto
Plating Polishing Buffing Burring

If you have a finishing problem why not call on LEA . . .
our many years of technical research and practical shop experience are at your service.

LEA GRIP-MASTER
POLISHING WHEEL CEMENT
matching the high quality of other Lea Products, is now obtainable through
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Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions.
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Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Mich.
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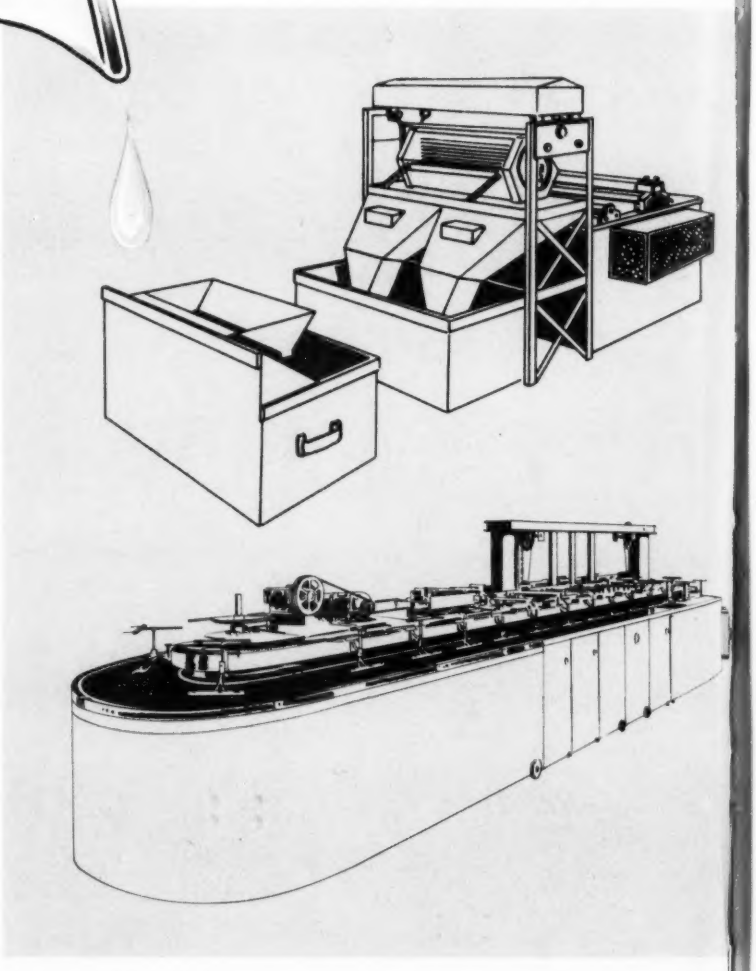
Lea-Ronal, Inc., Main Office and Laboratory: 42-48 27th St., L.I.C. 1, N.Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

Are you interested in Plating Specialties? **SEE THE OTHER SIDE OF THIS INSERT.**

SUPERTARTRAL*

. . . looking for improved results from your cyanide copper solution?



SUPERTARTRAL, industry's proved replacement for Rochelle Salts and Potassium Tartrate in *any* cyanide copper plating operation, offers the following advantages:

SUPERIOR Anode Corrosion, making maximum use of plating metal.

SUPERIOR Tolerance to numerous metallic impurities such as Chromium, Calcium, Barium, Magnesium, etc.

SUPERIOR Deposits with less tendency for roughness, caused by metallic impurities such as might be introduced with hard water.

SUPERIOR Cost Savings when used at recommended concentration; where operating characteristics of standard and bright baths utilize Rochelle Salts at 6 oz./gal., SUPERTARTRAL offers 20% savings over Rochelle Salts and 23% saving over Potassium Tartrate.

SUPERIOR Cyanide Stability . . . Lea-Ronal SUPERTARTRAL reduces cyanide breakdown with its resultant carbonate formation.

SUPERTARTRAL has been thoroughly and successfully production tested in still tank and barrel installations of conventional and bright cyanide copper processes, including the widely used Lea-Ronal Bright Copper Process.

LEA-RONAL Products are the result of careful research and development which guarantees that they are not put on the market until ready.

Your constant search for improving plating operations and for lowering costs, warrants thorough investigation and trial of LEA-RONAL SUPERTARTRAL.

The
LEA GROUP
serving the Finishing Field

Lea-Ronal, Inc., Long Island City, N. Y.
Lea-Michigan, Inc., Detroit
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Plating Polishing Buffing
Burring

Lea-Ronal Inc.

Main Office and Laboratory
42-48 27th Street, Long Island City 1, N. Y.
Manufacturing Plant
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Are you interested in Buffing, Polishing and Burring Specialties? SEE THE OTHER SIDE OF THIS INSERT

addition of spray equipment to the straight vapor unit at any time desired. A manually operated thermostat maintains a constant vapor line, 18" above the level of the solvent. With a drum size of 22½", this provides a working area adequate for most cleaning operations. The inside of the drum is covered with a coating of butyral rust-inhibitive. Both degreasers are available with casters for easier transfer.

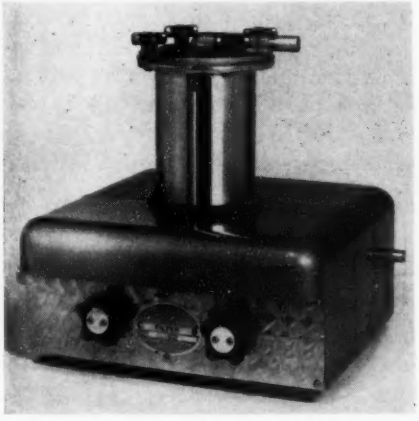
Laboratory Model Filter

Bart-Messing Corp., Dept. MF, 229 Main St., Belleville, N. J.

Increased filtering capacity in a compact space, simplified operation and quick, convenient maintenance are combined in the new portable Sel-Rex "Streamliner" filter, now being manufactured.

Designed for use in the laboratory, small production shop or pilot plant, the filter has a capacity of 250 GPH and can be used with either the new annular element or porous stone, for either acid or alkaline solutions. The unit measures 14" square at the base and stands 14" high.

Sturdily constructed throughout, the filter is furnished with stainless steel and rubber lined components or all



iron parts. All working parts are completely protected from dirt and drippings by the cabinet, which serves as a firm base for the portable unit.

It is claimed that this is the only filter on the market that can be cleaned in five minutes because of unusual design features. The hand tightened cover can be quickly removed, and the entire element lifts out so that it can be thoroughly washed to remove sludge. Filter bags, made of Dynel, Orlon, cotton or other specified materials, can be washed and reused.

Utilizing the annular element which is characteristic of all filters in the company's line, the new device is

SAVE with ENLEY ... Get Your

Demineralized Water at 2¢ — 4¢ per Gallon

IT'S NEW! The PERMA-DEMON

YOU can't beat the new Enley PERMA-DEMON for low initial cost and low per gallon cost. Improved manufacturing methods, reduced overhead and the radically new designed PERMA-DEMON all combine to bring you Demineralized Water at lower cost per gallon than can be obtained from any unit of comparable size.

The PERMA-DEMON is the only Water Demineralizer of its size that does not require Cartridge Replacement by the Manufacturer. It performs with the same economy as any larger Cartridge Type Demineralizer. Available now.

AT THE AMAZINGLY LOW COST OF ONLY $17.95 Complete

Comes packed with built-in carborundum porous stone filter and fiberglas screen.

SPECIAL FEATURE: The ion-exchange material can easily be removed and the PERMA-DEMON refilled with fresh material which can be obtained at the lowest net cost anywhere.

CHART BELOW EXPLAINING COST PER GALLON

mineral content parts per million (as $CaCO_3$)	output-Gallons per refill (1 pound of material)	cost per gallon per lb. of material — in cents
50	210	1.4c
100	102.5	2.75c
150	69	4.0c

based on material costing $3.25 per lb. and credit of 50c per lb. for exhausted material returned to Enley Products Inc. NET COST OF MATERIAL $2.75 per lb.

Other units available of larger res.n capacity at comparable prices. Write for full details.

FULLY GUARANTEED

We Guarantee our products to perform as advertised or we refund your money.

FOR PROMPT DELIVERY ORDER NOW!

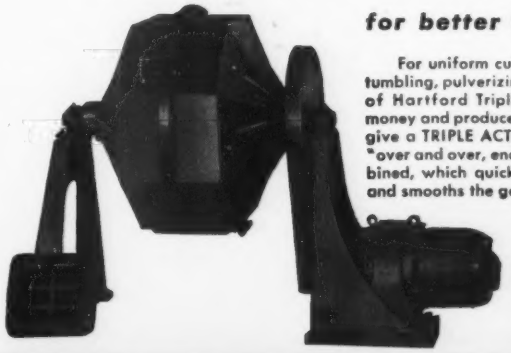
ENLEY PRODUCTS, Inc.

1236 BROADWAY (DEPT MF-3) BROOKLYN 21, N. Y.

HARTFORD *TRIPLE ACTION*

CUTTING *and* TUMBLING BARRELS

for better work in less time!



For uniform cutting down, wet or dry grinding, tumbling, pulverizing and mixing, the unique design of Hartford Triple Action Barrels saves time and money and produces better results. Hartford Barrels give a TRIPLE ACTION in tumbling the material, an "over and over, end to end, folding-in" motion combined, which quickly grinds off burrs, and finishes and smooths the general surface of any article in the load. These barrels are available in two sizes, large and small, and with both motor and belt drive. Hartford also makes steel burnishing balls scientifically correct in design and material for each specific job. Bulletin on request. 2HS52R

THE HARTFORD STEEL BALL CO.
Hartford 6, Connecticut

DETROIT 2 — W. S. TURNER, 446 NEW CENTER BLDG.
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CHICAGO 6 — VICTOR R. CLARK, 605 W. WASHINGTON BLVD.
NEW YORK DISTRICT NEWARK 2 — 1060 BROAD ST.
KANSAS CITY 8, MO. — T. R. WHITE, 1919 BALTIMORE AVE.
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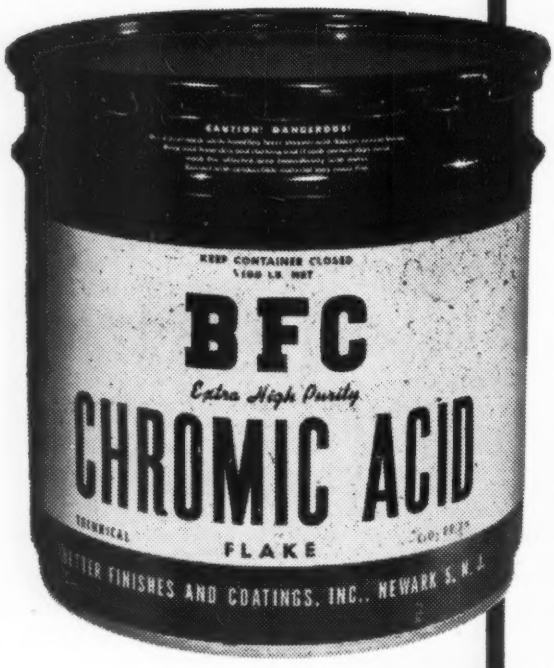
looks good-
is good



First thing you notice about BFC Chromic Acid is its shiny cherry-red color as it comes off the flaker. It looks good and it is good. Its chemical analysis is as fine as its physical appearance.

Our plant is modern; beautifully equipped; operated by men who are real proud of the product they make. Your orders will get personal attention of owner-managers who value your business. When you are in the market, why not call us?

BETTER FINISHES & COATINGS, INC.

268 Doremus Avenue,
Newark 5, N. J.

122 East 7th St.,
Los Angeles 14, Calif.

L. A. Critchfield

stated to have twice the filtering capacity and area of other filters of comparable size. However, when desired, the unit can be converted for use with porous stone elements. No additional parts are required for conversion.

BUSINESS ITEMS

R. O. Hull Announces Appointments to Staff

R. O. Hull, president of *R. O. Hull & Co., Inc.*, Rocky River, Ohio, manufacturers of electroplating specialties, announces the appointment of *Joseph L. Jackson* to head of research and development. Mr. Jackson received his Bachelor of Science degree in chemistry from the University of Michigan in 1948 and his Master's degree from Case Institute of Technology in 1952. Previous to joining the company, he was engaged in research for the past six years at the laboratories of the National Advisory Committee for Aeronautics at Cleveland, Ohio.

Joseph L. Jackson

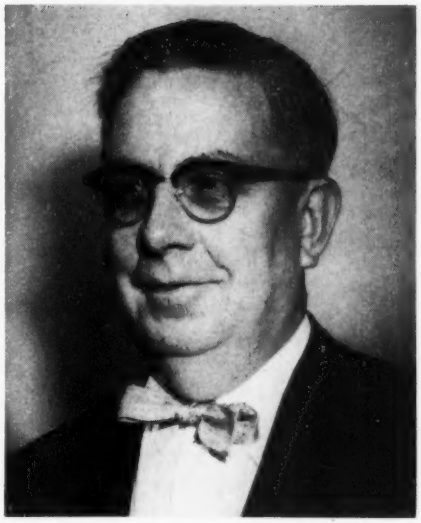
L. A. Critchfield has joined the sales and service department as technical representative serving southern Ohio, Kentucky and West Virginia. Roy Critchfield brings to platers in that area his wide experience in plating production and supervision as well as his well qualified background in the territory as a field service engineer. Headquarters for the area are in Dayton, Ohio.

The company, recently completing its tenth anniversary in the field of developing and manufacturing addition agents for electroplating, anticipates to soon occupy its new main office and laboratories now nearing completion adjacent to the present plant site. The one-story brick building consisting of 4500 square feet of floor space was added to make room for increased facilities relative to new products and processes research and customers service administration.

The former office and laboratory space will be taken over by manufacturing activities which are currently being increased 50% in line with business growth.

Bart Messing Names Ross Sales Vice-President

Announcement of the appointment of *William H. Ross* as vice president of sales for *Bart-Messing Corp., Sel-Rex Precious Metals, Inc.*, and *Detroit*



William H. Ross

Die Casting Corp., associated companies in the Bart-Messing organization, has been made by President *Morris M. Messing*.

In his new position, Mr. Ross will be primarily concerned with the expansion of the national sales activities of the three companies. Widely known in the electroplating industry, he was formerly vice president of sales with *Wagner Brothers*, of Detroit, and has been associated with the *Udylite Corp.* as Michigan district sales manager and with *United Chromium Corp.* He is an active member of the Detroit Branch of the *American Electroplaters' Society* and the Detroit Engineering Society.

Rampe Mfg. Incorporates

After operating for eight years as a partnership, *Rampe Manufacturing Co.*, 3320 St. Clair Ave., Cleveland 14, Ohio, have incorporated their business, effective January 1, 1955. Officers of the Corporation are *John F. Rampe*, president and treasurer; *W. Charles Rampe*, vice president; and *Paul A. Rampe*, secretary.

The company has three lines of products — Custom molding of injection and compression plastics; — The manufacture of Tether-Tennis, an outdoor family game; — and the manufacture of a line of Tumbling and Screening Machines in the lower price range.

Alvey-Ferguson Acquires Cincinnati Automatic Conveyor Company

The *Alvey-Ferguson Co.*, 75 Disney St., Cincinnati 9, Ohio, has acquired *The Cincinnati Automatic Conveyor Co.* and the manufacture of its "Trol-e-veyor" light-weight, easily-installed overhead conveyors. *James A. Gailey*, inventor of the conveyor and former owner of the latter company has joined the Alvey-Ferguson sales and engineering staff.

James A. Gailey

Mr. Gailey, a resident of Cincinnati and a graduate of the University of Cincinnati in mechanical engineering, has had wide experience in both sales and product engineering before he developed the conveyor system. A veteran of World War II, Mr. Gailey served in several theaters of operation as a pilot with the U. S. Air Transport Command.

Udylite Secures Judgement On Bright Nickel Patent

On January 17, 1955, judgement

PRECLEANING Cuts Waste... Improves Results!

Magnus Aja-Lif Cleaning Machine for precleaning with any suitable Magnus Precleaning Material.

Stop wasting the cleaners you use to get a chemically clean surface for electroplating. Precleaning takes off most of the dirt to a physically clean surface, avoiding contamination in final alkaline or electro-cleaning operations.

Stop wasting manpower in hand cleaning operations on hard-to-remove buffing compounds, cutting oils and similar dirts.

Stop wasting effort in trying to remove solid dirt particles which do not come off wth vapor-degreasing methods.

Let Us Show You What Economical PRECLEANING is

There are a number of Magnus Cleaners ideally adapted to precleaning operations, each rendered more effective and economical when used in Magnus Agitating Cleaning Machines of suitable capacity and design to meet your production requirements. On the majority of precleaning operations, Magnus Precleaner (dip or spray), followed by a thorough water rinse, will give you parts ready for all finishing operations except electroplating . . . and in far better condition for final cleaning for plating.

ASK FOR A DEMONSTRATION
. . . in your plant or in the Magnus Pilot Plant Laboratory

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11 South Ave., Garwood, N. J.

We would like to have a demonstration of Magnus Precleaning Methods.

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COMPANY_____
ADDRESS_____
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There is a difference!

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Plating Quality

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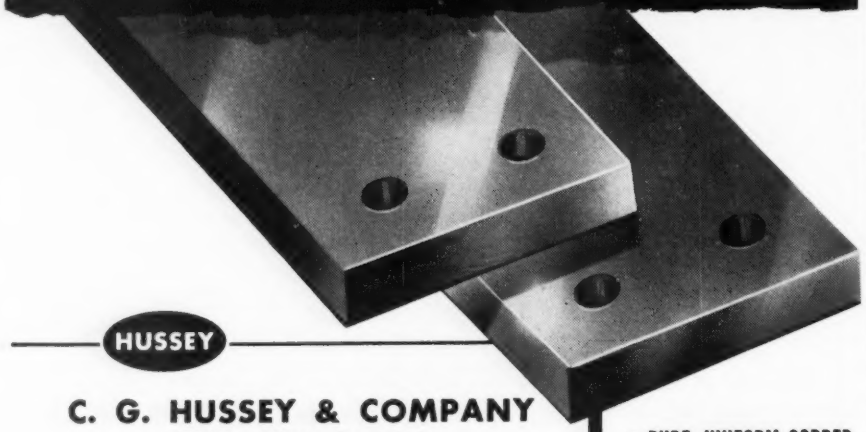

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was entered in the District Court of the United States for the Eastern District of Michigan, Southern Division, decreeing that U. S. Patent No. 2,191,813 granted on February 27, 1940, and owned by the *Udylite Research Corp.* for electrodeposition of nickel from an acid bath is good and valid in law.

The defendant, *Sandro A. Saporta*, a former Udylite employee, was adjudged as having infringed the patent by using bright nickel plating solutions and practicing methods constituting the patented inventions by actively inducing others to infringe the patent and by manufacturing and selling brightening agents for use in the patented solutions.

It was decreed that a perpetual injunction be issued restraining the defendant from using the solutions and practicing methods constituting the patent, from inducing others to infringe the patent, and from making, using or selling the brightening agents covered by the patent.

Diamond Alkali Expands

Diamond Alkali Co. is now modernizing and enlarging certain key facilities of its research center in Painesville, Ohio, at a cost of approximately $200,000 to meet the expanding needs of the firm's fundamental and applied research programs, it was announced by *Thornton F. Holder*, research coordinator for this major producer of basic chemicals for industry and agriculture.

Contract for the project has been awarded to the Hubert Rust Construction Company, of Painesville, which already has started to work on the job.

The research center modernization program includes the installation of a new radiation research laboratory for investigating potential applications of atomic energy for chemical applications. Alkali and electrolytic products research, directed by *C. C. Brumbaugh*, will also be expanded. Likewise, other company research groups will benefit, with improved facilities being made available for intensified research devoted to plastics, calcium carbonates, chlorinated organics, and chromates.

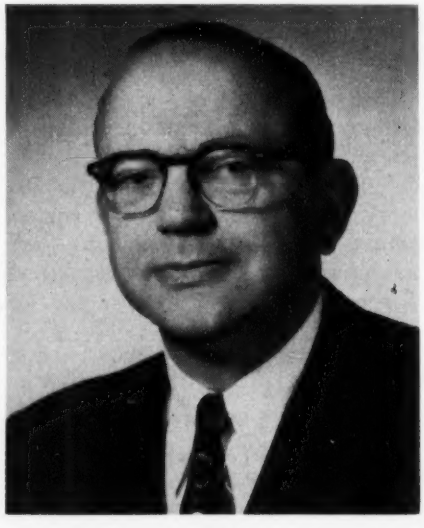
The new facilities are expected to be completed and put into full-scale operations in early spring.

Sennett To Allied Research

Harry Lee Sennett has joined *Allied Research Products, Inc.*, Baltimore manufacturer of the Iridite line of chromate conversion coatings, as sales engineer. He was formerly a sales engineer with the metal finishing division of the company. Mr. Sennett will coordinate specification activities with various government agencies responsible for specification of chromate coatings. In addition, he will serve customers in the Delaware, Maryland, Virginia area. Mr. Sennett's headquarters will be at the company's home office at 4004 East Monument St., Baltimore 5, Md.

Sarco Companies Elect New Officers

Clement Wells, founder and president of *Sarco Company, Inc.* and *Sarcotherm Controls, Inc.*, has retired to live abroad. The management and operation of the companies have passed



L. Barfus

H. L. Simmons

to the same executives who have served as directors for many years, and who have a total of more than 150 years of service with the companies.

These directors are: *L. Barfus, H. F. Collins, R. W. Cumming, A. Milnes, J. Service* and *H. L. Simmons.*

The new officers are:

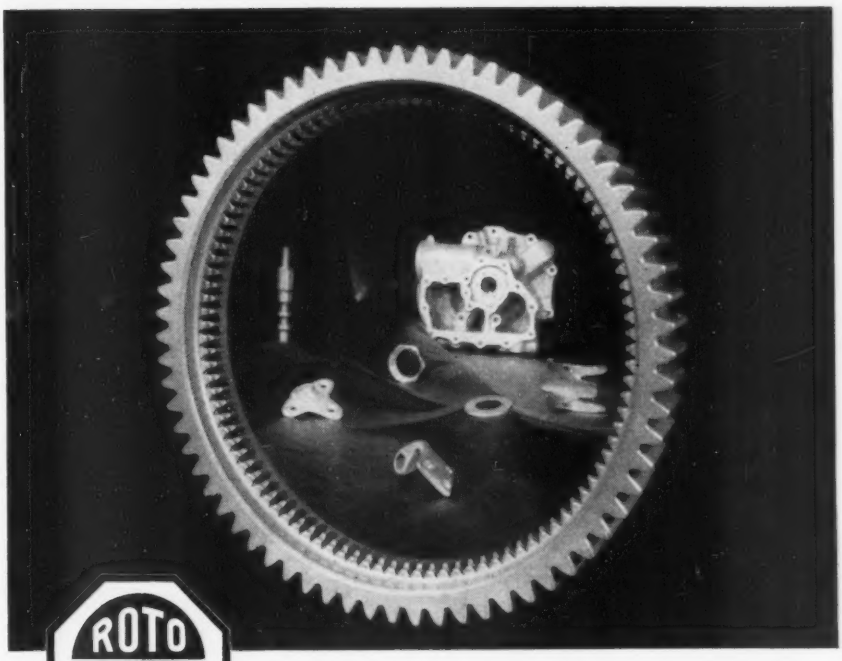
Sarco Company, Inc. — President and Treasurer, H. L. Simmons; Vice Presidents, R. W. Cumming and A. Milnes; Assistant-Treasurer, L. Barfus; Secretary, M. Mohr.

Sarcotherm Controls, Inc. — President and Treasurer, L. Barfus; Vice President, R. Stevens; Assistant-Treasurer, H. L. Simmons; Secretary, F. Schneiderman.

Canadian H-VW-M Company, Ltd. Acquires F. B. Stevens of Canada, Ltd.

William Whalen, vice president and general manager of *Canadian Hanson & Van Winkle Co. Ltd.*, has announced their purchase of the business and assets of *Frederic B. Stevens of Canada Ltd.* The transaction was concluded in early January.

Canadian Hanson & Van Winkle Co. Ltd., are Canada's senior supplier to the Canadian metal finishing industry. They operate two manufacturing plants in Toronto and have an office, warehouse, and service laboratory in Montreal and resident representatives in the principal industrial centers in Canada. The acquisition of Stevens adds an important link in Canadian Hanson's program, in particular providing office, warehouse, and manufacturing space in Windsor plus additional office and warehouse space in Toronto. Foundry sales are being handled by a separate sales division and the metal finishing activities are being merged into the present organization.



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Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

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International Nickel Appointments

The appointments of *Albert P. Gagnebin* as assistant manager of the Nickel Sales Dept. and of *Edward B. Bitzer* as assistant manager of the Nickel Alloys Dept. of *The International Nickel Company, Inc.*, were announced recently by *Lars R. Larson*, vice president and general sales manager of the company.

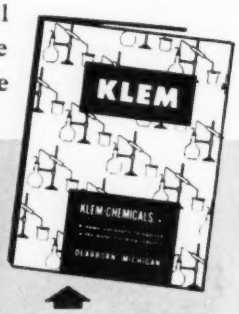
Mordica and Edwards Assigned to Pennsalt's Gilron Unit

John Mordica and *Gene C. Edwards*, veteran members of the *Gilron Products Co.* sales staff, will continue to service their respective accounts following consolidation of their organization with the *Pennsylvania Salt Mfg. Co.*

Mr. Mordica joined the Gilron organization in 1945 after nine years service on the sales staff of the Firth Steel Co. Prior to that assignment he was associated with the Wire Division of Bethlehem Steel. He received his technical education at the University of Maryland.

Also a veteran in the metal processing field, Mr. Edwards served successively as plating supervisor for the Standard Steel Spring Co., and superintendent of the plating department of the Chrysler Corp. Before he became a member of the Gilron sales organization six years ago, he represented the Frederick B. Stevens Co. in Cleveland.

It's the quality of the job you get and the savings in material, time, heat, etc., that make KLEM chemicals preferred. That's why one of the largest and most modern plating operations in the automotive industry recently chose Klem chemicals in preference to all others. The Klem man in your area may have the answer to your tough problem — if he doesn't the Klem lab does. Send us a sample for trial.



WRITE FOR THIS CATALOG

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C. P. Lavelle

Finishing Div. of the *United States Hoffman Machinery Corp.* of New York City, was announced by *Revis L. Stephenson,* vice president in charge of the industrial equipment divisions of the corporation.

Mr. Lavelle formerly was plant engineer for the Sikorsky Helicopter Division of United Aircraft Corp., Bridgeport, Conn. In the past, he has also been associated with Kaiser Metal Products of Bristol, Pa., and Chance-Vought Aircraft of Dallas, Texas.

The Metal Finishing Division designs, builds and installs mechanized automatic and semi-automatic systems for the cleaning and finishing of metal parts. Included is phosphating as well as electrostatic spray painting or chemical plating. Systems for the elimination of stream pollution; paint booths; paint baking ovens, and pressure vessels and weldments for the process industry are also available.

Jernstedt to Head New Westinghouse Manufacturing Laboratory

The appointment of *George W. Jernstedt* as director of a new manufacturing laboratory of the *Westinghouse Electric Co.* has been announced by *D. C. Burnham*, vice president in charge of manufacturing, and *W. C. Allen*, director of manufacturing and equipment engineering.

The purpose of the new laboratory Mr. Jernstedt will head is to develop improved methods, techniques, and equipment for manufacturing needs. For the present it will utilize facilities already existing in Pittsburgh.

Mr. Jernstedt joined the firm in 1936, one year before he received a bachelor's degree from Newark Col-

Qualified Applicators Now Available for Handing New Sprayable Plastisol

Experienced applicators of chemical-resisting protective coatings are now being qualified throughout the country by *United Chromium, Inc.*, to apply its new sprayable plastisol known as Unichrome Coating 5300, it was announced by *D. R. Meserve*, sales manager, Organic Coating Division. This new application service is intended to make available the advantages of plastisols to companies which lack facilities for applying them.

Applicators are qualified on the basis of their experience in working with different types of protective coatings as well as for their knowledge of the many industries in which protection against corrosion is required.

The coating was developed to permit spray application of vinyl plastisol films of much greater thickness than was heretofore possible. As the first practical sprayable plastisol, this new coating can be applied at room temperature to cold vertical surfaces to produce single coat, seamless, dry films up to 20 mils thick without sagging. Previous materials on similar applications seldom provided more than 6 mils per coat, usually much less.

U. S. Hoffman Machinery Corp. Appoints Lavelle

The appointment of *C. P. Lavelle* as division manager of the *Hygrade Metal*

George W. Jernstedt

lege of Engineering. After substantial experience with the Meter Division, he was given a year's leave of absence to obtain the degree of Master of Science in chemical engineering from Michigan State College.

He later served as a liaison engineer with the company's Central Engineering Department in East Pittsburgh and as manager of electroplating projects. In 1951 he was named manager of the special products development section.

Diversey Appoints Bennett

W. E. Noyes, vice president in charge of sales for *The Diversey Corp.*, Chicago, recently announced the appointment of *Myron T. Bennett* to promotional manager of the Metal Industries Department.

Bennett previously was general manager of the Spec-Kem Co., a Diversey division, supplying special chemical compounds to government agencies.

In his new capacity, Bennett will direct the sales of the company's fastest growing department.

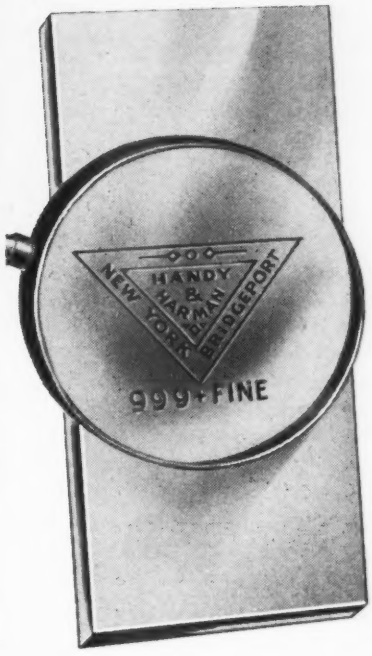
International Rectifier Appoints Hunter

International Rectifier Corp., El Segundo, California, announces the addition of *A. R. Hunter* to their application engineering staff.

Mr. Hunter received his Electrical Engineering and B.S. degrees from Iowa State College in 1916. He was formerly employed by the Wagner Electric Corp., Los Angeles, Cal., serving that company for seven years as an outside sales engineer for electric motors and transformers.

Mr. Hunter will serve the company in the capacity of sales and application engineer for the company's wide range of selenium and germanium semi-conductor devices.

No need to do this... when you plate with SILVER ANODES that bear this stamp



Handy & Harman 999 "Plus" Fine anodes take the "gamble" out of silver plating. They assure you of *highest quality* plating every time—and at *low cost*—because that stamp is your guarantee of:

1. Highest possible standards in fineness.
2. Complete freedom from impurities that can cause plating troubles.
3. Unvarying uniformity in fineness and plating properties.

Try the Handy & Harman 999 "Plus" Fine brand next time you buy silver anodes. We're confident you'll be surprised at the difference.

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Bridgeport, Conn. · Chicago, Ill. · Los Angeles, Calif.

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E. A .Tice is Transferred to Inco's New England Technical Field Section

E. A. Tice, a member of the Corrosion Engineering Section of the Development and Research Division of *The International Nickel Co., Inc.*, for the past eight years, is being transferred to the division's New England technical field section at Hartford, Connecticut, according to an announcement by *Donald J. Reese*, assistant manager of the division. The transfer is effective as of February 1, 1955.

Before joining Inco in 1946, Mr. Tice was a corrosion engineer in the research department of Bethlehem Steel Co. He graduated from Rensselaer Polytechnic Institute in 1939 with the degree of Bachelor of Science in Chemical Engineering.

Mr. Tice is a member of the *American Society for Testing Materials*, *The National Association of Corrosion Engineers* and the *Electrochemical Society*.

Federated Metals Forms Aluminum Department

Keeping pace with the dynamic growth of aluminum in industry, *Federated Metals Division, American Smelting and Refining Co.*, New York,

has established a national aluminum department, according to *E. L. Newhouse, Jr.*, vice president.

Allan Nichamin, active for more than 27 years in the aluminum smelting field and formerly manager of the firm's aluminum producing plant in Detroit will manage the new department. His office will be located in Detroit.

Mr. Nichamin is vice president of the Aluminum Smelters' Research Institute, a member of the American Foundrymen's Society, and served on Aluminum Industry Committees for NPA and OPS during the Korean emergency.

Donald L. LaVelle, formerly research metallurgist in the central research laboratory, has been appointed assistant manager of the aluminum department. His office will be located at the company's Perth Amboy, N. J. plant.

Mr. LaVelle, a member of American Foundrymen's Society, American Institute of Metallurgical Engineers, and American Society for Metals, graduated from the University of Washington in 1941 and Montana School of Mines in 1942 with a B.S. and M.S. in Metallurgical Engineering degree, respectively.

Jack Hanney Honored By United Chromium

Jack Hanney, a former president of the Grand Rapids Branch of the A.E.S., was recently honored by his co-workers at *United Chromium*. The occasion was Mr. Hanney's 10th anniversary as a sales and service engineer with the company. A luncheon attended by all members of the Ten and Twenty Year Service Clubs working out of the Detroit office of the company, was held at the Fox and Hounds Restaurant. Those in attendance represented more than 300 years experience in servicing the metal finishing industry.

Jack Hanney (on right) sales and service engineer of United Chromium, being presented 10 year service award by Bob Dudley, District Sales Manager of the company.

Mr. Hanney has long been an active participant in affairs pertaining to the A.E.S. A regular attendant of A.E.S. Conventions, Jack is as well known in other parts of the country as in Michigan where he has served the industry so well.

New Ultrasonic Company Formed

The incorporation of *The General Ultrasonics Co.*, 1240 Main St., Hartford 3, Conn., to manufacture and market industrial ultrasonic processing equipment has been announced by *Alexander S. Keller, Stanley R. Rich* and *Dr. Wilfred Roth*, all of West Hartford, Conn.

The new corporation will handle the Rich-Roth "400" ultrasonic generator and associated transducers, which has already been successfully introduced.

Terry New President of Seymour Mfg.

The directors of *The Seymour Mfg. Co.* have announced the election of *Robert M. Terry* as president of the company to succeed *Alton G. Wentworth* who resigned that position on February 1st.

Mr. Terry joined the company in September of 1954 and was immediately elected executive vice president and a director. Prior to his association with the wellknown metals producing firm, he was affiliated with The Abbott Ball Co., in Hartford, as executive vice president, general manager, secretary and director. Before that, he was engaged for more than 23 years in industrial engineering for several prominent petroleum producers. These included Cities Service, The Tide Water Oil Co., and The Shell Oil Co. At present, he is also a director of The Mathews Mfg. Co. in Worcester, Mass., and a past president and director of the Waterville Realty Co.

Mr. Wentworth has devoted practically his entire business life to his activities with Seymour. Although retiring as president by his own request, he will continue to serve the company on a part time basis as a consultant and advisor on sales and customer relations.

Hughes Joins Northwest Chemical

Joseph R. Hughes has joined the sales and engineering staff of the *Northwest Chemical Co.* to service accounts in Massachusetts and Rhode Island.

Mr. Hughes, a long time resident of Massachusetts, has for nearly twenty years worked with the metal finishing industry. His academic background and industrial experience, augmented by special training given by the company, will enable him to render technical service of a high orders.

Mr. Hughes will work out of his home office, 10 Mercer Road, Needham Heights, Mass.

Sliger Appointed Permutit Assistant Export Manager

The Permutit Co., New York, manufacturers of ion exchangers and water conditioning apparatus for commercial

The "MAGIC TOUCH" that SELLS and EXCELLS

SPEKYELLO

U.S. Pat. No. 2,198,365

The Original and Standard SIMULATED GOLD TRI-METAL ALLOY ELECTROPLATE

Give your products the "magic touch" of beauty and greater sales appeal with SPEKYELLO, the Golden, Triple-Metal Alloy Plate. ●A FAST PLATE—EASY TO OPERATE. No special equipment is needed. A steel tank may serve for both plating bath and anode. Produces a uniform color, eliminates costly rejects and troublesome color matching. Also solves your tinted lacquer problems. SPEKYELLO'S high throwing power enables it to penetrate deep recesses, ideal for basket plating. Plates directly over nickel, german silver, brass, copper, iron, and steel; also overall hard solders and most soft solders. Can also be used as an undercoate.

The Beautiful Bronze that Really LOOKS LIKE GOLD

☆

COLOR RANGE From 14 Kt. to a Pink Gold Color

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UNIFORM COLOR Eliminates COLOR MATCHING

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LOW COST INDUSTRIAL and DECORATIVE FINISH

UNLIMITED APPLICATION—You just can't beat SPEKYELLO for plating of hardware, handbag frames, novelties, etc. Its *low cost* makes its application *unlimited*.

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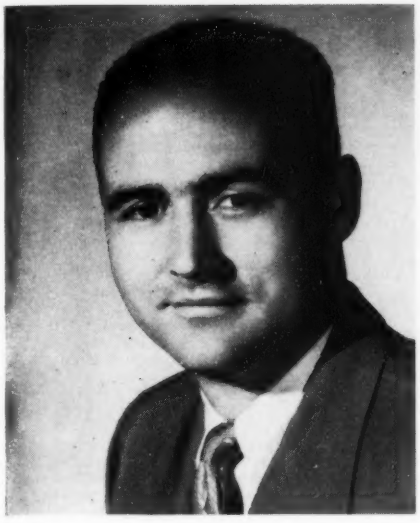


Herbert B. Sliger

and industrial applications, has announced the promotion of *Herbert B. Sliger* to the position of assistant export manager. In his newly-created office, he will be able to devote full time to the important work of developing sales of the company's varied line of products throughout the "free" world.

Mr. Sliger, who will report to *Col. Thomas P. Browne*, export manager, joined the export department in 1948 upon graduation from Rose Polytechnic Institute, Terre Haute, Ind., where he received his Bachelor's degree in Chemical Engineering. He is a member of the Interamerican Association of Sanitary Engineers.

Carborundum Acquires Curtis Machine Co.

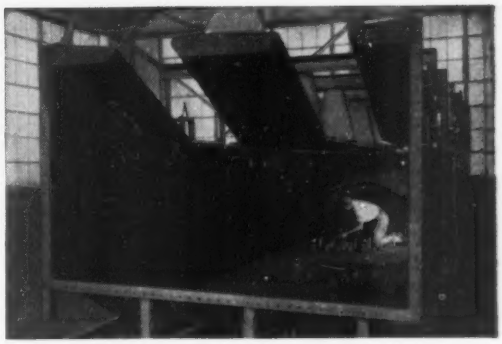
The Carborundum Co., Niagara Falls, New York has acquired the *Curtis Machine Corp.*, according to a joint announcement by *Gen. Clinton F. Robinson*, president of Carborundum and *Gene DeMambro*, president of Lincoln Park Industries, Inc. of which Curtis Machine was a wholly owned subsidiary. Carborundum exchanged 8696 shares for the entire capital stock of Curtis Machine.

Mr. DeMambro, president and general manager of Curtis Machine since 1946, will continue in that capacity, reporting to *Wm. H. Wendel*, vice president in charge of Carborundum's Coated Abrasives Division in Wheatfield, New York. Mr. Wendell will coordinate the activities of Curtis Machine in The Carborundum Co.

Curtis Machine has operated in Jamestown, N. Y. since 1913.

HOW TO BUY RUBBER LINING

FOR PERMANENT PROTECTION Against Corrosion and Contamination



Look for the company with the most advanced techniques and facilities for applying thick rubber lining to metal equipment of any size or shape.

Inferior rubber linings that crack or oxidize add to the cost of expensive equipment used in steel pickling and metal plating operations. In addition to corrosion of equipment, contamination of solutions can destroy the high quality of a finished product. Make certain the rubber tank linings you buy provide thick, inseparable protection for your equipment; eliminate stray plating currents and costly contamination in your process.

Specify the rubber linings proved to provide permanent, positive protection for your metal finishing operations . . . specify Manhattan Rubber Linings.

RM 523

MANHATTAN RUBBER LININGS

Manhattan engineers have developed a method of bonding rubber to metal so securely that tests prove it can't be separated. Manhattan Rubber Linings are made from thick, calendered sheets of natural or synthetic rubber for maximum durability . . . they expand and contract with the metal under temperature changes without hardening or cracking. To further assure lifetime protection, every Manhattan rubber lined tank is tested under high voltage to detect any possible defect. Whether your equipment is simple or intricate, large or small, Manhattan facilities and rubber engineering craftsmanship insures the safe handling of your rubber lining project. Let an R/M lining engineer help you with your rubber lining or covering problems.

RUBBER LINING PLANTS AT PASSAIC, N. J. and NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Acme Expands Again

Acme Mfg. Co. of Detroit, Mich., announce an expansion of their plant facilities from 73,000 square feet to 85,000 squart feet. The expansion was made necessary because of new equipment recently developed and the demand of industry for automated metal finishing equipment.

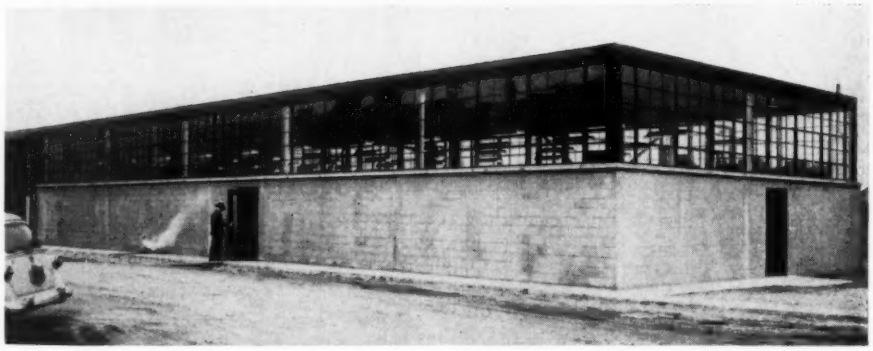
Construction of the additional facilities is now under way with completion expected this month. This is the sixth post-war expansion for the company.

Accompanying photo shows the additional plant area nearing completion at the right.

Phelps Dodge Opens Chicago Warehouse

Phelps Dodge Refining Corp., New York, has opened a warehouse in Chicago where stocks of all grades of Triangle Brand copper sulphate and nickel sulphate will be available for truck pickup. This will be the company's third shipping point, the other two being El Paso, Tex., and Laurel Hill, Long Island.

The address of the new warehouse is 5310 West Sixty-Sixth St., Chicago 38, Ill. The Chicago sales office of the company has been moved from 230 North Michigan Blvd. to the new warehouse.



Michigan Chrome Opens New Laboratory

The opening of a new and larger chemical laboratory to serve the Chemical Division of the company is announced by *Robert J. Huber*, president, *Michigan Chrome and Chemical Co.*, Detroit 13, Mich.

The new laboratory has the latest modern equipment necessary for the development of new Miccro products and plastisols, maintenance of high manufacturing standards, and assistance to customers in working out their coating and production problems.

A staff of seven chemists, headed by *Dr. Robert M. Lacy*, will use the 4,000 square feet of floor space in the new laboratory.

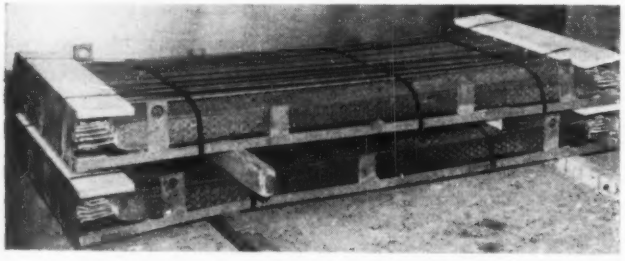
New Distributing Firm Formed

A new firm has been formed, *Hydromatic Metal Finishing, Inc.*, at 18931 St. Clair Ave., Cleveland 10, Ohio, featuring a complete line of precision deburring equipment. More than thirty years of industrial experience have been brought into the firm, it is estimated by its general manager, *Mr. Latshaw.*

They are set up to distribute nationally Rampe tumblers, Crown barrels and Mecha-Finish mechamatics; their own barrel finishing equipment and compounds, also buffing compounds and buffs; and to sample process any amount of parts in any kind or size in the laboratory. Several new aluminum finishes are also being offered.

Diamond Alkali Promotes King

Promotion of *James O. King* to the position of special staff assistant in the sales department of *Diamond Alkali Co.* at its national headquarters in Cleveland, Ohio, was announced by



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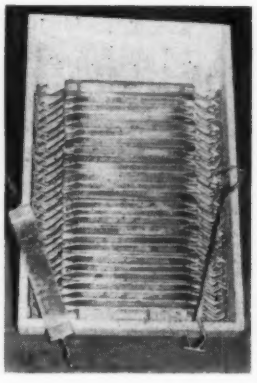
STORTS Specification Anodes of lead and steel, made to measure for your job, bring repeat orders due to their fine performance and exceptionally long life. Let us take over your anode problems — we fabricate both standard and special shapes.



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Manufacturers of Welded Fabrications to Specification

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Complete Service for Metal Finishing

Products Listed Below Available in New York Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds	Tallow	Nickel Salts
Brushes	Rouge	Copper Salts
Buffs	Emery Paste	Cyanide
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Tripoli Comp.	Emery	Plating Barrels
Acme White Finish	Glue	Polishing Wheels
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FILTERS

MAIZO Drying Materials

LEA Buffing & Polishing PRODUCTS

W. H. McConnell, vice president — sales. The appointment is effective immediately.

Mr. King comes to his new post following four and a half years experience as a member of the firm's southwestern district sales staff. He has represented the company in a sales and service capacity since July, 1950, in certain sections of Oklahoma, Kansas and Colorado.

A native of Oklahoma, born in Sentinel, Mr. King joined the organization shortly after graduation in 1950 from the University of Tennessee, Knoxville, where he earned a B.S. degree in chemical engineering, and was immediately assigned to the company's southwestern district sales staff at Houston, Texas.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Rochester Branch

The Empire State Regional Meeting of the American Electroplaters' Society will be held at the Hotel Seneca in Rochester, N. Y. on April 16, 1955.

Technical Program Completed for Electroplaters' Convention

Titles of papers scheduled for presentation at the 42nd annual convention of the *American Electroplaters' Society* have been announced by the convention committee.

Completion of the technical program, to be held in Cleveland, June 20th through 23rd, 1955, is announced by *Eugene L. Combs*, general chairman. Mr. Combs reports that the subjects are calculated to cover the most significant operating areas for producing better finished products at lower cost to industry.

Here are tentative titles of the papers:—

Liquid Level Control
Recovery of Waste Cyanide Zinc
Plating Powdered Metallurgy Bronze Parts
High Speed Brass Plating
Materials of Construction for Plating Rooms
Anodic Etch of Ferrous Parts Before Plating
Surface Preparation
Fatigue of Plated Steel Parts
Job Shop Costs
Tin Plating of Copper Wire
Nickel and Copper Plating on Coils
Copper Plating on Steel for Telephone Drop Wires
Effect of Ripple on Plating
Filtering and Handling of Chromic Acid Solutions
Handling of Waste and Waste Treatment
Finishing and Plating of Beryllium and Beryllium Alloy
Vacuum Metallizing
Anode Current on Phosphatized Copper Anodes
Flow Coating of Paint

Names, titles and company affiliations of speakers will be available soon, as well as abstracts of the papers themselves.

The *Industrial Finishing Exposition*, to be held concurrently with the technical sessions in Cleveland's Public Hall, will attract about 200 exhibitors of finishing equipment, services and supplies, according to Mr. Combs. Ex-

BRIGHTER

Barrel Nickel Plating with TRUE BRIGHT NICKEL BRIGHTENER

Increase Production

easy to control . . . cuts down on trouble that entails costly delays.

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can be operated at a higher speed.

Reduce Rejects

gives unbelievable uniformity of deposit in recesses . . . brighter, white color.

Write for **FREE** *bulletin revealing tricks on improving your nickel plating and cutting costs.*

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J. Holland & Sons offers you the most comprehensive operation in the entire finishing industry. Because we maintain one of the world's largest in-stock supplies of polishing, plating and spray equipment; we can deliver *in-stock merchandise immediately upon your request.*

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hibits will occupy both the upper level hall and the lower level hall. Two meeting rooms, one on the upper level and another at the lower level, will house the technical sessions.

Pittsburgh Branch

A record for both dinner guests and attendance at a regular meeting was set at the Pittsburgh Branch monthly meeting held at the Sheraton Hotel's Avalon Room, Wednesday evening, January 5, 1955.

Three new members were welcomed into the branch, *C. H. Walton*, *W. C. Sittmann*, and *M. A. Petrucci*. A total of 46 members surprised Mr. Ryan, Sheraton caterer, for dinner, but as usual he arose to the occasion. For the meeting there were 76 members and guests. This large attendance is easily attributed to the speaker for the evening, sort of a command performance for the members connected with the tin mills.

After a short business meeting the librarian introduced the speaker, *Dr. L. P. Gotsch*, associate director of research and technical service for American Can Co. Dr. Gotsch talked on the "Quality Aspects of Electrodeposited Tin Coatings Important to the Manufacture of Containers." He traced the rapid development of electrodeposited tin since the last war, the tremendous surface area covered, how extremely thin tin coatings differ from other commerial coatings, and the scope of the problems involved.

After a brief pause for refreshments Dr. Gotsch drew the name for the monthly door prize. *James R. Crain* of Westinghouse was the fortunate winner, of a Sunbeam electric iron presented by *Charley Churchill* of Cowles Chemical Co.

Detroit Branch

The January Meetitng of the Detroit Branch was held in the Wayne Room of the Statler Hotel, January 7, 1955.

The meeting was called to order at eight P. M. by *Joe Gurksi*. A colored movie, "Trout a la Shoshone," trout fishing at Lake Shoshone near Yellowstone National Park, was thoroughly enjoyed by the 200 members attending.

Bob Racine introduced 17 persons nominated for membership into the society. A motion was made by *H. Head* and seconded by *J. C. Drinkwater* that they be accepted. *Fred Olmstead* told his usual story and introduced *H. Kaforski*, the general chairman of the meeting.

Dr. R. Harr, of Western Electric Co., Chicago, was introduced by the general chairman. His subject for the evening was, "Non-Electrolytic Chemical Treatments for the Plating Room." Dr. Harr's talk covered the history of chromate coatings on zinc and cadmium from World War I to the present time. He discussed the "Cronak" process and also the New Jersey Zinc Company's Patent #2,106,904, which superseded the Cronak Process. His talk also covered phosphate coatings on zinc and oxide coatings and steel. There was a short question and answer period after Dr. Harr's speech. The meeting was adjourned at ten P. M. and refreshments were served.

Waterbury Branch

The regular monthly meeting of the Waterbury Branch was held on Thursday, January 13, 1955 in the Colonial Room of the Hotel Elton. Following dinner served at 6:00 P. M., President

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since 1937

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Model ASI-600 . . . Cap. 600-900 g/hr. Sethrin* Resin Filter Assembly. Stainless Centrifugal Pump. Totally Enclosed Motor . . . portable . . . Wt. 150 lbs. 2'x2'x2'.
Distributors in principal cities.
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PARTIAL LIST OF MODELS

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11"x14"x12"	30 lbs.
LSI-10	100 gal/hr	12"x16"x16"	40 lbs.
ASI-300	300 gal/hr	2'x2'x2'	125 lbs.
ASI-600	600 gal/hr	2'x2'x2'	150 lbs.
RLS-1200	1800 gal/hr	2'x3'x3'	300 lbs.

SERVICE . . . Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.
DESIGN . . . **Filter Assembly** fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. **Filter Tubes** of cotton, dynel, porous stone or porous carbon. **Pumps** fabricated of Hastelloy, stainless 316 or plastic; centrifugal or self-priming. **Motors** drip-proof, totally enclosed, or explosion proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. **Hose**—special acid and alkali resistant. **Base**—Linen Phenolic laminate on rubber tire ball bearing casters.

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Perry Sloane called the business meeting to order at 7:00 P. M. A lively discussion, led by *Joe Petrocelli*, centered around the question as to whether or not the Branch favored a membership committee. The topic of Branch Exhibits also received about a fifteen minute discussion.

Technical Chairman, *E. T. Candee*, opened the technical session by introducing *Dr. George Dubpernell* who gave a brief review of two books on pH measurement. An impromptu speaker, *William Phillips* of Deering Millikan Co., New York, N. Y., gave a brief talk on the technical aspects of buffing wheel fabric.

The main speaker, *Francis T. Eddy*, manager, Technicraft Laboratories, Inc. gave an excellent summation of "Plating Room Organization." A very lively discussion followed.

William P. Innes
Publicity Director

Central Michigan Branch

The January meeting of the Central Michigan Branch was held at the Meadow Lark Inn, Jackson, on Jan. 11, 1955. Following a delicious chicken dinner served family style to the 25 members and guests present, the meet ing was called to order by President *Fred Stuckenburgh*. After a few opening remarks by the president the meeting was turned over to *F. I. Young*, the librarian, for introduction of *C. H. Sample*, of the International Nickel Co., the principal speaker of the evening.

Mr. Sample took as his subject "Corrosion Behavior & Protective Value of Electrodeposited Coatings." He also presented a series of slides to illustrate his discussion.

Several new members were accepted into membership in the Branch. They are as follows: Messrs. *A. B. Covey, H. C. Everett, H. E. Kratzer, E. S. Spraker, N. J. Lenneman, B. N. Sisco, D. D. Trafelet, C. Wilson, A. L. Simpson*. All of these gentlemen are affiliated with the Oldsmobile Division of G.M.C. The signing into membership of these new men was due to an intensified membership drive carried out by the 2nd Vice President of the Branch, *R. L. Carter*.

Final plans for the Annual Ladies Nite Program, to be held the evening of February 8th, 1955, at the Porter Hotel, Lansing, were discussed and finalized. Mr. Stuckenburgh requested the following members to assist him on ticket sales: *Ray Carter, Ed Bosca, Bill Moegle, Floyd Young*, and *Dick Boos*.

R. W. Boos,
Publicity

Grand Rapids Branch

The January 14th meeting of the Grand Rapids Branch was attended by approximately fifty members.

President *Carl Green* rapped the meeting to order on a new speakers' rostrum, which he had constructed for the branch.

Two new members were elected into membership: *Earle Lee Blakeslee* of the Artcraft Co. and *Werner Blumenthal* of the A.M.I. Corp. The branch offers a hearty welcome to these gentlemen.

Lyman Sperry introduced a motion to clarify the rules of the branch paper awards. At the same time, it was the consensus of the members to increase the amount of the awards. The motion was carried, so now this branch will give a member $50 for presenting an original paper before the branch and $100 for presenting a paper at a National Convention or having one published in PLATING. A second motion

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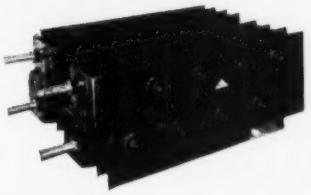
Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.



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Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs.

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

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A barrel load of bright nickel with a nickel's worth of

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CORROSION RESISTANCE UP 30% TO 100%

With Nickelite you can get 13 to 22 hours of salt spray exposure with 0.00006 inch of barrel nickel, instead of 11 to 13 hours. Actual salt spray tests show even greater improvement with thicker deposits. And you're saving money, too!

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proposed by Sperry, gave any member $5.00 for contributing an article to the "Tricks of the Trade" column. The Grand Rapids Branch feels very proud of its paper awards program, which certainly should stimulate authors to write papers for publication.

Librarian *Tom Henner* introduced *Richard Landon*, Kanigen Division, General American Transportation Corp., Chicago, who spoke on "Kanigen Electroless Nickel."

Kenneth Hampel
Publicity Chairman

Newark Branch

The regular monthly meeting of the Newark Branch was held at 8:30 p.m., June 21, after a showing of the film *Howard Cobb*. A total of seventy was in attendance including all officers and editorial board members *Bill Geissman, Dan Gray, Jack Winters* and *Ed Bowerman. James Adams*, the new *Plating* production manager was introduced. The business meeting included acceptance of membership applications from *Salvatore Fresco*, Fresco Silver Plating Co. and *Paul J. Theussen*, Metal Processing Co.; the election to membership of *Paul Topelian, Harold Kelshaw* and *David Siversten;* a report by Secretary *George Wagner* that the Christmas party was a financial success; and a request that *John Banta* draw up a resolution stating the concern of the Newark Branch re New Jersey water resources.

Cliff Struyk, librarian, then introduced *Ray Abazia* of the Curtiss-Wright Aeronautical Corp., who discussed the use of electroless nickel for plating aircraft cylinders, probably the oldest commercial application of the process. The aluminum cylinders are plated individually in glass containers with 0.0005″ to 0.0007″ of nickel and heat treated to improve the hardness and ductility. The alkaline bath is used but Mr. Abezia stated that, for most general work, the acid bath is satisfactory.

Hubert Goldman, Enthone, Inc., was then introduced and presented an interesting paper relating adhesion of electrodeposits to the condition of the base metal prior to plating. He also described the alkaline derusting process and pointed out how under certain circumstances this method can remove metal and greatly improve adhesion by removing the amorphous layer. Normally, no metal loss occurs, however. Ordinarily the process is operated at 25-50 asf, but can go to 700 asf and can use PR current, 7 seconds anodic to 10 seconds cathodic. The process was demonstrated by Mr. Goldman and colored slides shown of certain applications. The talk was well received by those present.

D. Gardner Foulke,
Recording Secretary

New York Branch

The New York Branch meeting on Friday, January 14th, 1955 at the Hotel Statler, New York City, was called to order by President *A. Amatore*. The rall of officers was called and *Martin Maher* was noted absent. The following resolution prepared by the Executive Board to be incorporated into the Branch By-Laws, was presented to the Branch:

To be eligible for election as an executive officer in the New York Branch of the American Electroplaters

For the first time:

BRONZE PLATING

as a **DECORATIVE FINISH**—for die cast parts, hardware, TV escutcheon plates, handbag frames, etc.

- *May be plated fully bright or dull, with excellent coverage.*
- *Offers a new color closer to gold than brass.*
- *Gives a brighter finish than copper.*

as a **SINGLE UNDERCOAT FOR CHROMIUM**—for cutting costs by eliminating one plating operation and several rinses; for decreasing metal use through more uniform plating.

- *Has greater throwing power than copper or nickel.*
- *Offers better resistance to corrosion.*
- *Leaves a smooth, satiny deposit at high plating speeds.*
- *Buffs readily with less tendency to drag or cut through.*

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Society, a candidate must have 5 years practical experience, and be actively engaged in production plating in a supervisory capacity, research or chemical control position. Any change in status while in office will automatically terminate the terms of office.

The executive officers noted above are President, 1st Vice President, 2nd Vice President, Secretary-Treasurer, and the Board of Managers. There was a motion made and seconded that the Branch incorporate into the by-laws the above resolution, and it was voted in unanimously. There being no other business, the meeting was turned over to *Peter Veit*, librarian, who in turn presented *Milton Nadel*, past president of the Branch.

Mr. Nadel's talk was "Low Current Density Purification of Electroplating Solutions," which was most interesting to all.

Lester Levinson,
Recording Secretary

Boston Branch

Boston branch of the A. E. S. has set April 30, 1955, as the date for their annual banquet and technical session to take place at Boston's Hotel Statler. Feature speakers for the technical session have not as yet been announced. The banquet will feature the Statler's usual excellent prime roast beef, dancing, entertainment and door prizes.

Indianapolis Branch

Despite the rainy weather forty members and guests attended the dinner of the Indianapolis Branch. At 8:00 P. M. an additional five members came. The guests included *L. J. Howald*, secretary of the Cincinnati Branch. The order of business included introductions, secretary's and treasurer's reports. Committee reports were one by *Quentin Shockley* on annual educational and dinner-dance plans and also a report from *Les Reynolds* and *Marshall Whitehurst* on plans for an Indianapolis Branch display at the Cleveland convention.

Correspondence consisted of an announcement of the Chicago annual affair on January 29th. A letter from St. Joe Valley Branch was read announcing the candidacy of *Duke Wysong* for 3rd vice-president. One of our members, *Rex Oyler*, sent in his resignation and the secretary was instructed to write sending regrets.

Under new business, *John Holland* announced he is to present the "Paper" at the national convention. One of our faithful members, *Tom Evans*, is in the Methodist Hospital for a check-up. The branch wishes him the best.

Herb Kennedy again reported on the Columbus, Ohio meeting of March 26th stating he hoped we all could go.

An interesting idea was brought up by *Ed Bruck* and that was to have an organization through the national A. E. S. to investigate and place those in the plating field who are unemployed. Further information will be presented about this at a later date.

The program for the evening proved that, to belong to the A. E. S., a member does not always have to be given a technical program in order to maintain his interest. *Al Huber*, chairman of the Marion County Crime Commission was the speaker. Since this commission is fairly new, as it was organized in 1951, the group has done

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. . . the name of our new composite abrasive for hard buffing compounds used on non-ferrous metals . . . in laboratory tests and actual use TAMART has proven equal or superior to similar abrasives now in use . . . and of special interest to you, TAMART is far more economical.
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Improved Lucite PORTO-PLATER $167.50
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Obstruction-free cylinder. One-piece molded High Temperature Lucite shell welded to ends. No ribs—no tie rods—no crevices.
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Continuous Processing
Through alkali cleaning, rinsing, acid treatment and plating with one loading. Temperatures to 185° F. Weight, empty, only 28 lbs., capacity, 1/4 peck. Cylinder, 9x15" O.D., 6x12" I.D.; standard perforations 3/32" — larger or smaller perforations when specified.
Ask your BELKE Service Engineer or write.
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marvelous work cooperating with the various law enforcements of the city and county. Several points were cited as to the qualifications of a good law enforcement officer, also how he should be promoted. A very enthusiastic half hour followed the talk when almost all present had a question to ask. Refreshments were served at 9:30 and the meeting adjourned at 10:00 P. M.

Edna Rohrabaugh
Secretary

Cincinnati Branch

After a pleasant dinner, the meeting of the Cincinnati Branch was called to order by President *Bill Gordon* at 7:30 P.M. on January 26th. There were 28 members and guests present, who enjoyed a film prepared by the Argus Camera Co. on the manufacture and assembly of cameras. Minutes of the previous meetings in November and December were read and approved. Then, *Bob Rarick* gave a report to the Branch on the meeting of the Technical & Scientific Societies Council. This meeting concerned itself with method of making the Engineering Bulletin & Directory self-supporting. It was felt that committees could be appointed to sell and promote advertising in the Engineer & Scientist. Qualifications of applicant societies requesting membership were also discussed.

Ezra Blount gave a report on the progress of the Second Tri-State Annual Dinner Dance to be held in Columbus, Ohio March 26. Ezra noted that the Dayton Branch has definitely decided to participate. A committee has been activated consisting of *Herb Kennedy, Dick Jager, Bob Ruleff* and *Ezra Blount* to consider and recommend the appointment of a permanent Tri-State Committee. Announcement was made of bus service available to Columbus, Ohio on that date, and some future contact will be made with members to see if any are interested.

Tom Speers gave a Treasurer's report. *Will Loveless* gave a report received from the National Educational Committee, headed by *Clyde Kelly*, urging local branches to assist members in knowledge of electroplating. This topic was discussed for sometime, and not enough interest was evidenced to establish regular courses of training at this time. It was voted on and passed that there would be no March meeting because of the conflict with the Tri-State Annual Dinner Dance. Ezra Blount made a motion, which was passed by the membership, that two Branch representatives be appointed to a Tri-State Annual Dinner Dance Committee. Pres. Gordon announced that these representatives would be appointed at the next meeting.

Members were guests of the Chipman Supply Co. at the usual Social Hour.

L. J. Howald,
Secretary

Buffalo Branch

Friday, February 4, 1955 the Buffalo Branch met at the Markeen Hotel in Buffalo, N. Y. Three applications for membership were referred to the board of managers and eight members were suspended for non-payment of dues.

C. F. Paulson of the Permutit Co. gave an illustrated lecture on the "Application of Demineralized Water in the Plating Room." Many of the Buffalo Branch took part in the question period which followed the lecture. A rising vote of thanks was given Mr. Paulson for his excellent discussion.

On Friday, April 1, 1955 "Plating

Insure successful, economical, uninterrupted

ZINC PLATING

by purifying cyanide zinc plating solutions with

McKeon's

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TRADE MARK REG'D.

No Other Purification Treatment Required.
Simplifies Zinc Plating Procedure.
Substantially Reduces Overall Plating Costs.
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virtually eliminates maintenance!

Most striking feature of this trap is its simple design. Only one moving part – a solid stainless steel disc – virtually eliminates maintenance.

The trap is small, easily installed, immune to water hammer, vibration and corrosive elements. Uses same valve seat and head for all pressures to 600 psi and temperatures to 950°F.

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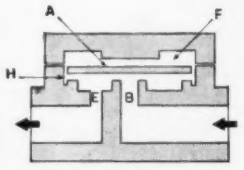

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2099-F

from Fluoborate Solutions" will be the subject of a discussion by *Clifford Struyk* of the General Chemical Division of the Allied Chemical & Dye Corp. Dinner will be at 6 and the meeting will start at 8 P.M.

Eric G. Sampson, Jr.,
Secretary

MASTERS' ELECTROPLATING ASSOCIATION

The *37th Annual Banquet and Entertainment of the Masters' Electroplating Association, Inc.*, 59 E. Fourth St., New York 3, N. Y., will be held on May 7, 1955. The reception will be held at 6:30 P.M. in the Terrace Room and the Banquet at 8:30 P.M. in the Grand Ball Room, of the Plaza Hotel, New York City.

The Masters' Electroplating Association, Inc. is the largest collective group of job finishing shop-owners in the New York area. Officers of the group are: *Al D'Agostino*, Chairman of the Executive Committee; *Sal Novelli*, Vice-Chairman; *Frank Kaiser*, Treasurer; and *Silvio C. Taormina*, Executive Secretary. Mr. Novelli is also the Banquet Chairman.

Tickets for the Annual Banquet (at $25.00 per person) may be obtained at Association Headquarters.

NEW BOOK

Metals Handbook — 1954 Supplement

Edited by Taylor Lyman. Published by The American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. 1954. Price $4.00 to ASM members, $5.00 to non-members. 184 pages, including index.

This volume supplements the 1948 edition of the ASM *Metals Handbook*, bringing it up to date with the addition of 24 articles prepared by 22 ASM technical committees. The recent authoritative information presented is bolstered by 326 illustrations and 155 tables on many phases of metals, their fabrication, and treatment.

The supplement would be considered a required purchase for all libraries which contain the 1948 handbook.

News from California

By Fred A. Herr

Gus Brigatino, owner of Brigatino Laboratories, 1200 West Slauson Ave., Los Angeles, has completed installation on new equipment for employing the Electrofilm process, a dry film lubricant application, on plated and anodized parts for the aircraft and electronics industries. Major equipment items consist of a spray booth, two electric heating ovens and liquid hone facilities.

Brigatino also operates Southwest Plating Co. at 1344 W. Slauson Ave., Los Angeles. The shop is equipped for cadmium plating, both still and barrel, hard chrome, copper, nickel and decorative chrome, and polishing, on such items as aircraft bolts and mis-

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cellaneous plane parts, precision electronic items and instrumentation devices.

C. Raymond Syer, Beverly Hills, Calif., finishing consultant, recently told this writer some interesting details of the trip around the world which he made last year as a consultant for a drum manufacturer to introduce epon resin materials in the Far East and Europe.

Chinese workmen in Singapore finishing shops, he found, work for 50c Straits per eight hour day. The lack of equipment and the illiteracy of many of the workmen is one of the major problems in the Far East, according to Mr. Syer, who supervised the construction in Singapore of a spray booth, a paint machine and a striping unit. The Singapore labor crew available to him could not read blue prints. But that did not deter them. To get around their inability to read the blueprints, the design of the machine was drawn on the floor in chalk. The workmen were able to follow the chalked outline so precisely, section by section, that a good job of installation resulted. Syder called it a "precision job." Most of the finishing equipment used in Singapore and the Straits Settlements as a whole is manufactured in the United States, and delay in getting deliveries, Mr. Syer reported, after it has been ordered, is a serious problem to effective operation.

Mr. Seyer also visited Australia and in Sidney addressed a group of 200 paint industry executives on drum lacquer as a corrosion resistant.

Harry Nash has joined the staff of International Rectifier Corp., El Segundo, Calif., as a sales engineer for germanium and silicon diode sales and applications. Nash served three years with the Signal Corps and Air Force engineering laboratories as a high frequency electronic application engineer. Most recently he was associated with Polytechnic Research & Development Co. as a staff engineer.

Spar-Tan Engineering Co., Los Angeles, has completed installation on three new 14 foot tanks for porous chromium plating of Diesel locomotive cylinders. Two of the tanks are equipped with four 5,000 amp. rectifiers with automatic voltage and automatic current control. The remaining tank is equipped with four 1500 ampere magnetic amplified voltage and current rectifiers. The new equipment supplements existing facilities with which the firm reconditions several hundred Diesel engine liners per month. Also completed recently at the Spar-Tan shop was a new iron plating department equipped to apply an underlayer on badly worn diesel engine liners prior to their being plated with chromium.

M. C. Bryant, industrial sales manager of Better Finishes, Inc., Newark, N. J., spent a week on the Pacific Coast between January 24 and 31st visiting various plating shops in Los Angeles, San Francisco and Seattle, Wash., and conferring with West Coast distributors of his firm's line of plating industry products.

In Los Angeles he visited the shop of Southwest Plating Co. and the Brigatino Laboratories, and the facilities of Superchrome Engineering Co.

At Superchrome, Mr. Bryant and his Los Angeles district manager, *Ralph Olson*, inspected what is believed to

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For all metals — abrasive and burnishing — non-darkening — non-corrosive — added brightness on zinc and aluminum.

WE CARRY A COMPLETE LINE OF NORTON ALUNDUM TUMBLING ABRASIVES FOR WEST COAST USERS

Write or call for free engineering and chemical service for your barrel finishing problems.

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For ALL Your Metal Finishing Needs Depend on DAVIES

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Inspecting new 45-foot deep hard chrome plating tank recently installed by Superchrome Engineering Co. of Los Angeles, are (left to right) Gus Brigatino, owner, Southwest Plating Co., Los Angeles; Fred A. Herr, Pacific Coast Editor of "Metal Finishing"; Ralph Olson, Los Angeles district manager, Better Finishes, Inc.; M. C. Bryant, Newark, N. J., industrial sales manager, Better Finishes, Inc.; John Millhorn, Millhorn Chemical & Supply Co.; Howard Woodward, California Rack Co., South Gate, Calif.; and Kasmir F. Tarczynski, general manager, Superchrome Engineering Co.

be the deepest hard chromium plating tank in the West, on which *Kasmir F. Tarczynski*, general manager of Superchrome Engineering, recently completed installation.

The tank, which is installed on a lot adjacent to the main plant, is 45 feet deep, 36 inches in diameter, and is topped by a steel derrick, resembling an oil well rig, 102 feet high. The derrick serves to facilitate reciprocating action of anodes during plating operations. The tank is used to hard chromium plate the I.D.'s of oil well tubes and core tubes up to 45 feet long, ranging from an I.D. of one inch to 24 inches.

With the Ninth Western Metal Congress and Western Metal Exposition as the main events, the metal finishing and fabrication industry of Southern California has in prospect a busy and informative period of technical conferences between March 19 and April 1 which, based on previous years figures, are expected to attract an attendance in excess of 50,000.

The annual Educational Session, Los Angeles Branch, A.E.S. will be held on March 19 at the Ambassador Hotel, 3400 Wilshire Blvd., Los Angeles, followed by dinner dance in evening. Four technical talks, starting 9 a. m., will be devoted to problems of metal deposition and allied matters, each followed by open forum discussion. The speakers: *William Castell*, Lockheed Aircraft Corp., Burbank, Calif., on "Aircraft Finishes"; *Edward Rinker*, Sel Rex Precious Metals, Inc., Belleville, N. J.,

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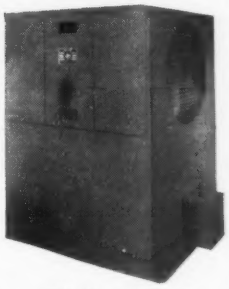

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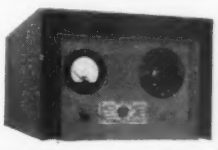

Ther also manufactures Bench Model Rectifiers. All models are drip-proof in construction, convection cooled and complete with stepless variable voltage control. Sizes range from 25 to 250 amps. 6 v., 150 amp. unit shown.

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STOCK ITEMS for QUICK SHIPMENT

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4 SIZES AS FOLLOWS —

5-gallon open conical, hexagonal Tumbling Barrel.

5-gallon closed hexagonal Burring Barrel — 17" dia.

1.1 cu. ft. (8 gallon) closed Hexagonal Burring Barrel — 17" dia.

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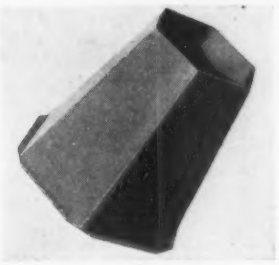
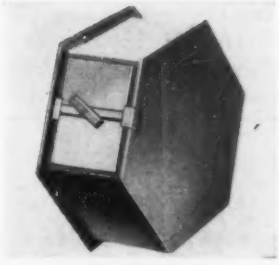
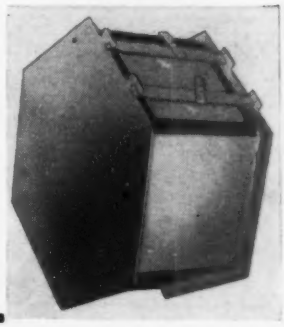
You can't make barrels like these at the prices quoted.

Write for information and prices.







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on "Precious Metal Plating": a talk on "Electroless Nickel" by a representative of the Kanigan Division, General American Transportation Co.; and a fourth paper on a timely finishing subject by a local speaker. Annual story-telling contest features noon-day luncheon.

From March 28 to April 1, the Ninth Western Metal Congress sponsored by American Society for Metals will be held at the Ambassador Hotel, Los Angeles. Five days of technical papers and discussion are scheduled in morning and afternoon sessions.

E. H. Dix, Jr., assistant director of research, Aluminum Co. of America, Kensington, Pa., addressed Los Angeles Chapter of the American Society of Metals on January 27 on the subject of "Aluminum Continues to Meet Competition." He cited the development of aluminum powder metallurgy, the evolvement of higher strength structural alloys, and the development of building sheets, coated and colored to meet present architectural trends, as points indicating that aluminum continues to meet competition.

Office, sales and warehousing functions of the Carborundum Co.'s Southern California division have been concentrated in a new building at 2626 South Malt Avenue, Los Angeles. *John G. Fritzinger*, formerly a sales executive in Niagara Falls, N. Y. has been named district manager, with supervision over the Los Angeles and San Francisco districts.

The move marked the culmination of a reorganization of Carborundum's sales and service operation in the West into what is now designated as the firm's Pacific District.

The new Pacific District organization is geared to bring together in a coordinated program the product sales and engineering services of all divisions of the company — grinding wheels, abrasive grains and powders, metal additives and other products of the bonded products and grain division, coated sheets, rolls, belts, discs etc.

The San Francisco district facilities have been moved into new quarters of some 23,000 square feet of floor area at Alviso Road and Evelyn Ave., in Mountain View, near San Francisco.

James Meehan has been named office manager of the San Francisco operations, with *Frank J. Blake* as sales manager for bonded products and grain. Personnel of the Los Angeles office includes *Wilfred Robson* as office manager, *William B. Summers* as sales manager for coated products, and *William H. Homeyer*, sales manager for merchandising.

Plomb Tool Co. has completed installation on an enlarged plating plant at its Los Angeles factory, 2209 Santa Fe Avenue, for use in finishing mechanics and automotive hand tools sold under the brand name of Proto.

Courses in electroplating, fundamentals of corrosion, and alloy metallurgy are included in the spring schedule of the Engineering Division, University of California at Los Angeles, which began in February.

Part II of a two-semester course in the science, techniques and practices involved in the various methods employed in electroplating for those engaged in some aspect of the field who wish to broaden their knowledge, began February 8. The class meets weekly on Tuesday night from 7 to 9:30 o'clock with *Mitchell Raskin*, factory manager of Ajax Hardware Mfg. Co., as instructor.

The course in fundamentals of corrosion is taught by *William E. Seyer*, professor of engineering, University of California. This latter course embraces a review of basic electrochemistry, theories of ionization and nature of the conductive process in solutions, theories of electropotential developed in cells, and decomposition potentials.

Rush Industrial Enameling Co., operated at 10827 Rush St., El Monte, Calif., by *Ivan W. Chambers*, has completed construction on a new 10,000 square foot enameling plant.

Mido Products of Torrance, Calif., manufacturers of barrel finishing compounds, has completed a new laboratory in Long Beach, Calif., to facilitate barrel finishing service for their increasing volume of new customers. The modern chemical laboratory will be headed by the firm's chief chemist, *David H. Green*, who also supervises the company's control and research laboratories in Southern California.

Arthur Pine, president, has appointed *Herman Ey* to engineer and manage a booth featuring barrel finishing at the Western Metal Exposition which will be held at Pan Pacific Auditorium, Los Angeles, March 28 to April 1.

Beckman Instruments, Inc., whose facilities formerly were distributed in various buildings in Pasadena, Calif., recently dedicated a new $2,000,000 plant in Fullerton, Calif. 12 miles east of Los Angeles. The plant of 200,000 square feet of floor area is located on Fullerton Road near Imperial Highway. It serves as corporate headquarters for the Beckman organization and as manufacturing facility for the main division. Initial engineering, produc-

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tion and sales personnel at the new plant totals 800. The 40 acre site reportedly provides room for tripling present floor space. pH meters, data handlers, spectrophotometers and scientific instruments for chemical laboratories, plating shops, hospitals and industrial plants are among the principal products manufactured by the company of which *Arnold O. Beckman* is president.

Mr. and *Mrs. Don Bedwell* of Los Angeles will see a long-standing dream materialize when the S. S. Lurline shoves off at Los Angeles Harbor for Honolulu on May 4. They have wanted to visit the islands for many years but every summer something intervened to sidetrack the plan. But now, Don reports, he's got the reservations, furlough from the shop arranged, and everything is set for him and his lady to spend a glorious 3½ weeks in the magic islands. A bon voyage party prior to the take-off is in the making by some of Don's plater friends.

Don has been active in the Southern California electroplating industry so long and with such distinction that the term "Mr. Plating" fits him well. His career in the industry covers four decades. He has operated shops of his own, is a two-time past-president of Los Angeles A.E.S. Branch, has been a frequent delegate to the national conventions of the Supreme Society, and is generally regarded as the respected elder stateman of Los Angeles Branch. He has been plant manager of the Hall-Mark Co., Los Angeles manufacturers of plumbing supplies, for a number of years.

A plant addition costing $200,000 to house the firm's stainless steel tube pickling operations is in course of erection at the Pacific Tube Co.'s plant at 5710 Smithway St., Los Angeles. Representing the firm's fourth expansion in recent years, the addition will reportedly double pickling capacity and is expected to be completed by March 1.

Robert W. Lester, formerly vice-president of California Alloy Products Co., has been named chief engineer of the Superweld Corp., North Hollywood, Calif. Another Superweld appointment is that of *Hoyt M. Todd* as chief metallurgist. Todd formerly was chief metallurgist for Kobe, Inc., and research metallurgist with Security Engineering Co.

OBITUARY

SAMUEL FORMAN WALTON

Samuel Forman Walton, vice president and technical director of *The Exolon Co.*, Tonawanda, N. Y., died January 20, 1955 at the Buffalo General Hospital after an illness of about a month.

Mr. Walton was born July 30, 1888 in Germantown ,Pa. He spent his youth in Washington, Iowa, where he graduated from the local high school. After working for the Western Pacific Railroad for a short time, he entered Iowa State College and graduated with a B.S. Degree in ceramic engineering in 1912. After several years in the refractory field, Mr. Walton joined the technical staff of *The Carborundum Co.* in 1916. Leaving in 1919, he spent three years with Kalmus, Comstock & Wescott, industrial engineers in Boston, Mass. From there he went to Pennsylvania in 1923 to manage a clay plant. In 1929 he established a personal business as a refractory engineer in Philadelphia, but sold out in 1927 to become associated as a ceramic engineer with Exolon. He later became technical director and, in 1950, was elected a vice president. He was responsible for much of the product development work which has been such an important factor in the firm's growth. He has several patents to his credit in the field of abrasives and refractories, both in their production and in their use.

He was a fellow of the American Ceramic Society and in 1942 received a professional engineering degree from the New York State College of Ceramics. He was a member of the Institute of Ceramic Engineers, N. Y. State Ceramic Association, Abrasive Grain Association, American Chemical Society, The Electrochemical Society.

He is survived by his wife, the former Alice Osann, his son and daughter-in-law, Mr. and Mrs. Samuel Forman Walton, Jr., of E. Woodstock, Conn., and two grandchildren, Stephanie D. and Cynthia L. Walton.

Manufacturers' Literature

Design and Construction of Acid-Proof Trenches

Corrosion Engineering Products Dept., Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Bldg., Philadelphia 7, Pa.

Based on years of actual application and experience, the company offers an aid to engineers in the design of trenches for carrying acids and corrosive liquids.

Complicated and time consuming

Zialite

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for NICKEL PLATING

The one bath especially designed for plating DIRECTLY on ZINC, LEAD, ALUMINUM, BRASS, COPPER and IRON.

for HARD CHROMIUM

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Harder deposits. Increased throwing power. Less sensitivity to sulfate content. Exceptionally fine results plating anything calling for Decorative or Hard Chrome.

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92 GROVE STREET WORCESTER 5, MASS.

Low head room — high lift — automatic load and unload and plenty of other "automation concept" features mark the Stevens *Stevadoer*, the newest addition to the complete Stevens line of Automatic Plating and Processing Machines. *Frederic B. Stevens, Inc., Detroit 16, Michigan.*

calculations are eliminated by the use of a quick and proven method of determining the size, slope, design and installation of trenches.

Construction Plans No. 608 is now available on request without charge.

Barrel Finishing

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

A new instructional booklet on barrel finishing has been released by the makers of Honite brand barrel finishing chips, compounds and equipment.

Called "There's Gold in Them Thar Barrels," the 10-page manual describes the basic steps involved in making trial processing runs, and makes recommendations for selection of media and compounds.

The publication also gives specific recommendations for barrel speeds, water level, time cycles and barrel loading; lists 11 compounds and the specific uses of each; and explains "self-tumbling" or rolling.

Metal Finishing Chemicals

Industrial Dept., Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

A new guide to the use of Wyandotte products for the metal working and metal finishing industries has just been issued. Known as Form 2199, simple directions are given for 12 major cleaning, stripping or processing operations. Under the 12 operations, 40 recommendations are given for products that fit various plant conditions.

The list of major operations discussed includes: barrel finishing, cleaning and phosphating, deoxidizing, oil and water absorbent, electrocleaning, paint spray booth maintenance, neutalizing, rust and scale removal, paint stripping, protection against rust, soak cleaning, washing machine cleaning.

Chlorothene Solvent

The Dow Chemical Co., Dept. MF, Midland, Mich.

Information on chlorothene (inhibited 1,1,1-trichloroethane), a new cold degreasing solvent, has been compiled in a pamphlet which is now available from the company's solvent sales department.

The pamphlet covers specifications, properties, relative evaporation rates, toxicity factors and vapor pressure.

Chlorothene's low toxicity, high solvent power and stability recommend it for cold-cleaning, dip-cleaning and bucket-cleaning operations.

Heat Exchangers

Niagara Blower Co., Dept. MF, 405 Lexington Ave., New York 17, N. Y.

Bulletin No. 124 describes the operation of the Niagara Aero heat exchangers used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photographs.

Blower Catalog

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio.

Complete dimensions, specifications, and performance data on the manufacturer's new non-overloading utility blowers with backward curved blades is presented in concise, easy-to-use form in a new bulletin, BC-11.

Data is given for the complete line which includes 2¼" to 36½" belt-drive blowers, 12¼" to 33" direct-drive models, 12¼" to 36½" Arrangement 2 blowers; 24½" to 49" Arrangement 3 single width, single inlet blowers and 12¼" to 49" Arrangement 3 double width, double inlet blowers.

Dust and Fume Control

Young & Bertke Co., Dept. MF, 2235-45 Buck St., Cincinnati 14, O.

The above firm has recently published a booklet on dust and fume control for all types of industries. The many illustrations show equipment engineered and designed to meet the requirements of large and small plants, for the removal of noxious fumes or excess heat.

Also included is a partial list of firms using their installations.

Surface Active Agents

Mona Industries, Inc., Dept. MF, Paterson 4, N. J.

A new, completely revised, folder on its line of Monamine surface active agents has just been issued by the above company.

The folder, No. 220, contains detailed specifications on the basic grades, as well as chemical, physical, and physiological properties on the entire line. Furthermore, complete information is given on use and compounding and a special sheet with suggested formulations on various types of cleaners is available.

Polishing Machines

Leiman Bros., Inc., Dept. MF, 102 Christie St., Newark 5, N. J.

A new four-page Bulletin No. 1455 illustrates and describes the firm's latest, improved line of polisher-grinder-dust collectors for light metal, novelty, jewelry, silverware and dental work. These compact, high-suction machines

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SERVING THE FINISHING INDUSTRY FOR
MORE THAN 50 YEARS
WITH A
Complete Line of Guaranteed, Quality
BUFFS & POLISHING WHEELS
INCLUDING PATENTED, VENTILATED & BIASED
STRAIGHT & 45° "SPOKE-BUFFS"
SOME SALES TERRITORIES AVAILABLE

SPEED-UP your nickel stripping **PROTECT** the base metal with **STRIPODE**
A proved addition agent, STRIPODE strips nickel plate faster and protects the base metal from pitting, roughening and etching. Also saves on use of acid, eliminates need of sand blasting or heavy buffing operation. Try it!
ORDER A TRIAL GALLON!
THE CHEMICAL CORPORATION
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have a built-in triple filtering dust collecting system, requiring no auxiliary equipment. Included are a light-duty model requiring only 18 x 29 inches floor space, heavy-duty models requiring 24 x 48 inches floor space and a new sit-down model requiring 19 x 36 inches floor space. Full specifications and details of operating principle are given.

Pickling Aids

E. F. Houghton & Co., Dept. MF, 303 W. Lehigh Ave., Philadelphia 33, Pa.

Two brands new pickling aids, plus an improved version of an established heavy-duty inhibitor, are described in the bulletin "Houghton Pickling Inhibitors," recently issued.

The three products are: Acitrol 3129, an improved non-foaming heavy-duty inhibitor now effective over a wider range of conditions than before. Acitrol 3130 is a new, foam producing pickling inhibitor which produces clean, smut-free surfaces and is specially useful where bright work is desired. Acitrol Foam 25 is a completely new cationic foam-producing chemical which can be used in any desired concentration to provide various foaming action. It produces a dense, continuous foam blanket which is free of all sludge-like contaminants.

Automatic Cut-off Switch

Hoffman Plating Co., Dept. MF, 6804 Park Ave., Cleveland 5, O.

A brochure, just off the press, is now available to the plating trade in the interest of safer, faster, more economical barrel plating through automatic control.

The literature describes the operation and performance of the new automatic cut-off plating switch and illustrates this switch in actual use on the job plating plant operation.

Information for the four page, 2-color folder originated with *August R. Hoffman* who designed the switch for use in his own plating plant. The switch worked so well, in the automatic control of his plant, that he decided to build and produce it for other plating plants throughout the country.

Quality Control For Welded Polyethylene

American Agile Corp., Dept. MF, P. O. Box 168, Bedford, Ohio.

The subject of "Quality Control For Welded Polyethylene" is detailed in newly published literature now available. The availability and simplicity of certain key tests enable polyethylene fabricators to insure soundly constructed process equipment meeting the most rigid specifications. Data given in the literature is based on material written by *Dr. J. A. Neumann* and *F. J. Bockhoff*, and is illustrated by nearly a dozen photographs. Reference sources for additional information are likewise given.

According to the literature, many methods are available for testing defects in polyethylene welds, both inherent and environmental. While each of these methods has its particular advantages, the most complete examination of a weld would be given by a combination of three tests: (1) a spark test for porosity; (2) a radiographic negative where necessary; and (3) a test for detrimental environmental effects according to the Agile test method 17-W, which is specific for each application.

Porous Teflon Filter Media and Filters

Porous Plastic Filter Co., Dept. MF, 30 Sea Cliff Ave., Glen Cove, New York.

Performance data on porous Teflon filter media promises to make heretofore "impossible" filter applications practical. Data are offered on the pore size of the new material as well as flow characteristics for air and water. Included also is information on the thermal and mechanical properties of the porous fluorocarbon. Criteria for proper selection of filter areas required are presented.

Heavy Duty Cleaner

Metasurf Corp., Dept. MF, 12830 Eaton Ave., Detroit 27, Mich.

A new anhydrous, heavy duty, alkaline soak or tank type cleaner for ferrous parts, called Metaclean #85 has been described in a technical bulletin.

Rubber Lining Tanks, Valves, Fittings

Metalweld, Inc., Dept. MF, Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

An illustrated, two-color, 8-page

HAVE YOU TRIED?

(1) ELECTROPLATING KNOW HOW, the home study course that betters your plating results? (2) WATER AND WASTE CONTROL FOR THE PLATING SHOP, the easy to follow, money saving guide? (3) The SUR-TEN METER, simple, quick and accurate way for controlling surface tension of plating baths and dips? (4) The STRESOMETER, the rapid and easy way for accurate plating stress measurements? Free details.

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METABOND is the only effective immersion or spray amorphous type zinc coating in the industry today.

METABOND withstands severe and consistent flexing and bending without chipping or breaking bond.

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MANUFACTURERS OF RUST PREVENTIVES AND CORROSIVE SOLVENTS

bulletin describes the advantages and application of rubber lining to steel tanks, drums, pipes, valves, fittings and pumps. Included in the bulletin are important tables giving the resistance characteristics of MW rubber lining to inorganic acids, salts and alkalies, organic materials and a wide group of miscellaneous materials. Details on the chemical, abrasive and temperature resistant qualities of rubber linings and the different types of linings available are also given. The firm's plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the bonding process which joins rubber and steel together with a bond strength of over 500 psi, is described.

Plastic Pipe and Fittings

Alpha Plastics, Inc., Dept. MF, 14 Northfield Road, West Orange, N. J.

How to use and specify rigid plastic pipe and fittings is the subject of a new 12-page catalog of the firm's standard line offered to design, maintenance and application engineers. The catalog is created to enable engineers to learn the modern uses for plastic pipe to keep their methods in step with product processing and maintenance improvements, and provides useful reference facts on ½" to 4" line of normal impact and high impact unplasticized polyvinyl chloride pipe and fittings, plus properties and characteristics data, together with detailed drawings and specifications of solvent-type fittings plus the new, injection-molded threaded fittings.

Featured is a corrosion chart classifying more than 275 corrosives rated according to desirability of use. Recommended and non-recommended applications are shown, based on company tests, user reports and field experience.

Ease of workability, installation of the plastic pipe in piping systems plus per ft. costs in schedules #40 and #80 pipe and ordering information, is included. Catalog will be distributed to qualified industrial engineers upon letterhead request.

Abrasive Band Wheels

Even-Cut Abrasive Band Co., Dept. MF, 8212 Carnegie Ave., Cleveland 3, Ohio.

The new Even-Cut band wheel catalog pictures the three types available which are (1) round shank units for chuck mounting, (2) wheels with threaded shanks for attachment to threaded spindles, and (3) heavy duty aluminum insert flange models drilled for arbor mounting.

Photographs in this new catalog portray band wheels being used for woodworking, deburring and patternmaking. Wheels are recommended for cutting or polishing any kind of wood, metal, plastic, rubber, leather, tile, etc. Also a breakaway photograph illustrates the principle by which the wheels give a perfectly flat cutting surface for their full width.

In addition, this new catalog gives list prices for all standard wheels and bands.

Use of Steam for Heating

Steam Heating Mfrs. Ass'n., Dept. MF, 450 East Ohio St., Chicago 11, Ill.

A capsule "refresher course" in the use and specification of steam for heating, this 16-page booklet, "What You Should Know About Modern Steam Heating," is the first step in a continuing program of helpful information to be released by SHEMA. It seeks to give heating system designers a con-

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cise source of information that will help them evaluate steam as a heating medium for specific types of installation.

An important section of the book is its "Outline for Steam Heat System Specification" — a complete checklist guide for a designer to follow in specifying a heating system with steam. The specifications cover 33 points in the system — from general conditions to final tests and guarantee. Many of the specification points are covered in detail, with exact recommended wordings.

Re-Usable Containers

Peters-Dalton, Inc., Dept. MF, 17900 Ryan Road, Detroit 12, Mich.

A recently published sixteen page brochure (Technical Bulletin No. 601) under the title of Re-Usable Containers and Special Products is abundantly illustrated. This two color booklet completely describes how many advantages can be gained by packagaing, storing and shipping industrial materials in scientifically constructed re-usable metal containers, as contrasted to outmoded packaging and shipping methods. Accurately describing the construction, this booklet points out how the lightness and compactness of the P-D scientific design combine with the feature of re-usability to result in most important economies in weight reduction and space saving. Other features include air fill valves to eliminate atmospheric dangers, drop handles for easy lifting, and closure features for simplicity in the closing and opening operations. Each container is constructed according to individual specifications.

Along with the re-usable metal containers this brochure describes the many engineering and production facilities provided by the company for fabricating special products to meet the customer's specifications and high standards.

Polishing and Grinding With Coated Abrasives

Behr-Manning Corp., Dept. MF, Troy, N. Y.

A 60-page "Production Digest" of authoritative papers on coated abrasive grinding and polishing techniques constitutes the first known effort on the part of a coated abrasives manufacturer to compile a handbook of the art, and is assembled from 20 technical papers prepared by the firm's methods engineers during the past two years for the leading periodicals of production engineering in both the metalworking and the wood-working fields.

Subjects covered included: coated abrasives theory and practice, contour polishing and grinding, the inside polishing of recesses and small openings, the conversion of polishing jacks to belt usage, contact wheels, part sizing and deburring, swing frame grinding, cylindrical stock grinding, abrasive belt lubrication, disc grinding problems, tolerance grinding of wide sheets, abrasive strapping techniques, special abrasive cloth shapes and their uses, the cutting of spiral-wound abrasive drum covers, the modern use of coated abrasives in wood finishing, and suggestions on cost cutting in production practice.

It is the company plan to issue future editions of its Production Digest as fresh material on yet uncovered subjects is published. The material is set 2-column on 8½" x 11" format,

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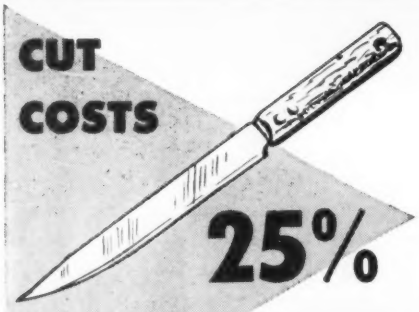

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and is illustrated with 122 photographs, 16 drawings and 4 tables or check lists. The authorities whose writings are assembled include *E. E. Oathout, Direk Olton, J. J. Durnan, J. Karl McLaughlin, Dr. Hugh N. Dyer* and *Harvey L. Bennett.*

"Canned Rotor" Pump Design

Chempump Corporation, Dept. MF, Station B, 1300 East Mermaid Lane, Philadelphia 18, Pa.

A new technical paper describes development of Seal-Less centrifugal pumps. The recently published 12-page paper details the design and development of centrifugal pumps that have no seals or stuffing boxes.

The article covers design history, early experimental work and outlines the basic problem of building an electric motor inside a pump. Included are detailed data and curves regarding temperature, pressure, and the effects of the unusual pump design on electric motor operation. New developments in the canned rotor pump field are discussed, and a series of operational case histories are given.

Rust Preventives

Rust-Oleum Corp., Dept. MF, 2799 Oakton St., Evanston, Ill.

The company's new 1955 general catalog provides an outstanding treatise on rust prevention and is dedicated to showing all types of industry how to stop rust.

The new, enlarged catalog feature 98 color chips of company products and includes complete instructions for surface preparation and application of their primers, short oil type, long oil type, machinery and implement finishes, chemical and heat resistant types, sealers, thinning oils, and floor and masonry coatings.

In addition, two pages of the new catalog are devoted to questions and answers. Thus, full and clear explanations are given on all problems relating to the surface preparation and applications of these products.

Plastic Valves and Fittings

The Lunkenheimer Co., Dept. MF, Box 360, Cincinnati 14, Ohio.

A comprehensive, completely illustrated, four-page circular describing Luncor, the first all molded polyvinyl chloride valve and fittings, has been published by the company, a pioneer in valve research and development for almost a century. The valve and fittings are claimed to have remarkable resistance to corrosive chemical action and resist most chemicals used in industry. The exclusive molding process gives the PVC material exceptional strength, protects its natural corrosion-resistance, and substantially reduces manufacturing costs.

Spray Pickling

Metalwash Machinery Corp., Dept MF, 901 North Ave., Elizabeth 4, N. J.

A free 12-page illustrated booklet "What You Should Know About Continuous Spray Pickling" is offered with an introduction on the process of spray pickling. The booklet discusses the pickling of drawn parts and the preparation of steel for porcelain enameling.

Die Casting Finishing by Abrasive Blasting

American Wheelabrator & Equip. Corp., Dept. MF, 1150 South Byrkit St., Mishawaka, Ind.

"Finishing Die Castings With a Wheelabrator" is the title of a new bulletin, No. 101-D, just published. This folder shows the application of airless abrasive blasting as done in the company's machines to the deflashing, deburring, and surface preparation work that is required for die castings. The elimination of porosity in die castings by airless blasting is also described.

Case histories from four typical companies are presented, together with operating data, showing savings that may be obtained by replacing conventional manual methods by the airless abrasive blasting process.

LETTER TO THE EDITOR

Comments by Dr. G. Gutzeit on Editorial "Electroplated versus Electroless Nickel"

Mr. Nathaniel Hall's editorial (METAL FINISHING, Feb., 1955), was submitted to the undersigned before publication; and in the event it was considered to present an unbalanced picture, a reply was invited. This courtesy is deeply appreciated.

Obviously, there can be no objective appraisal of recent technical developments without a large amount of practical experience in actual service, and

discussion of results; nor is it possible for specialists to have an entirely unprejudiced opinion of a new process, because their background influences their judgment. It is hoped that the clash of divergent thoughts will result in a fair and useful appraisal of the value of electroless plating for industry.

From a technical point of view, straight comparison between electroplated nickel and so-called "electroless nickel" is out of order. As often, names are misleading, because they are only shorthand symbols for complex facts.

The product of "chemical" nickel plating is not identical to nickel; nor is it a substitute for, or, generally speaking, an improvement over nickel. It is a different material, with many new properties, and should be judged upon its own merits for each specific application. Mr. Hall's remark about "purity" is a semantic pitfall. It is comparable to stating that, "where purity is a factor", steel does not show any advantage over iron, because it contains carbon.

Chemical plate is much harder than nickel (Vickers number 450-550 as deposited). Moreover, by proper heat processing, it can be brought up to a Vickers number of around 1000 — which corresponds to the hardness of chromium. On the other hand, it is considerably less ductile than nickel — a drawback for some applications. That condition can be corrected to some extent either by stress-relieving or by addition of certain organic chemicals to the bath.

The corrosion resistance of chemical plate is at least equal to that of nickel, and, in many cases, far superior. This can be attributed both to the well known stability of nickel phosphides in strong corrosive agents and to the homogeneous structure (absence of crystal boundaries).

The lack of porosity of electroless coatings has been repeatedly demonstrated by several methods (Ref. G. Gutzeit — METAL PROGRESS, 66, 119, July 1, 1954), and is entirely independent of the continuous filtration used in the "Kanigen"* process.

Direct deposition by chemical plating on zinc die castings is perfectly possible, and has been successfully achieved in the laboratory, although, at this time, adhesion is not as good as on most other materials. Furthermore, it is possible to plate directly on aluminum by electroless methods. A thin flash of chemical plate on aluminum makes the metal easily solderable — a great advantage over electroplating. Finally, non-conductors such as thermo-setting plastics, ceramics, glass, crystalline silicates and insoluble oxides can also be coated, without interposition of a mechanically bonded film.

The uniformity of deposit of chemical plating results in its economic superiority over electro-plating for the coating of large or irregular items such as valve bodies, compressor housings, conveyor screws, tanks, reactors, etc. In electroplating, whenever a minimum thickness of, say, five mils is specified, it is necessary to deposit at least eight mils; while the same degree of protection will be supplied by three mils of chemical plating. Companies experienced in nickel plating of large vessels have found that the chemical process is considerably less expensive for that type of application than standard electro-deposition. While, at this time, it is competitive only in special cases with electroplating (when a comparison is at all possible) the situation is rapidly changing. As stated by A. Brenner in his recent article (METAL FINISHING, Nov. & Dec., 1954) — which, incidentally, has already been dated by late developments — "*the real key to the economics of operating the electroless plating process is the cost of the hypophosphite.*" The price of that reagent has been constantly reduced as a result of increased consumption (being today about 50% less expensive than originally when purchased in large quantities), and will continue to drop, because new production methods from inexpensive raw materials are being developed. Moreover, solution life and recovery of all values from the depleted bath are being constantly improved.

While conventional electro-deposited nickel certainly retains its usefulness — particularly in the decorative field — it is believed that industry will become more and more aware of the unique advantages offered by chemical plating.

Dr. G. Gutzeit

Associate Director
Research & Development Department
General American Transportation Corp.

*"Kanigen" is a mark identifying chemical deposition of a high-nickel low-phosphorus alloy by General American Transportation Corporation and its licensees, and the coating resulting therefrom.

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